Vol. XVIII. THE NECESSITY FOR INCREASED WHEAT PRODUCTION. Part 4.

[Registered at the General Post Office, Melbourne, for transmission by Post as a Newspaper.]

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OF

THE DEPARTMENT OF AGRICULTURE,

VICTORIA, AUSTRALIA.

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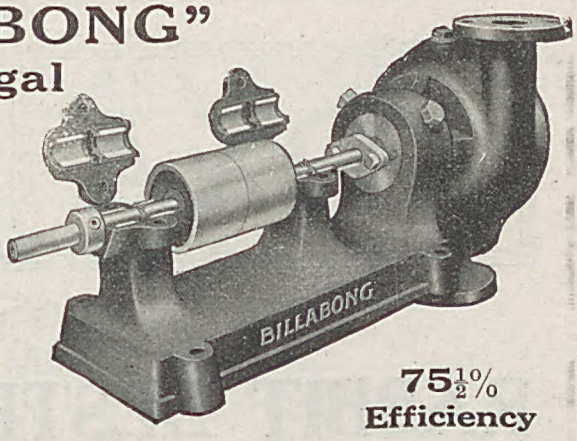

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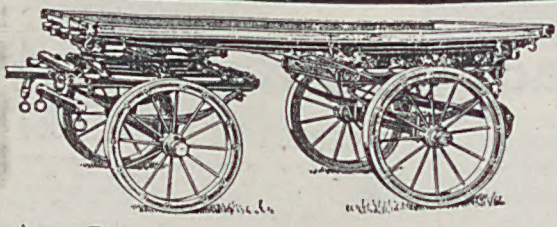

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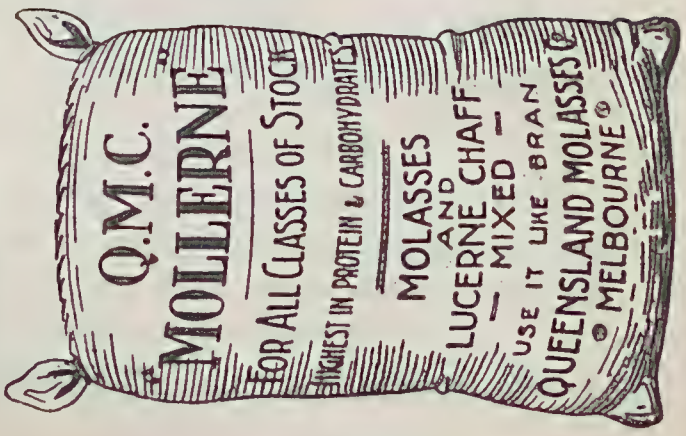

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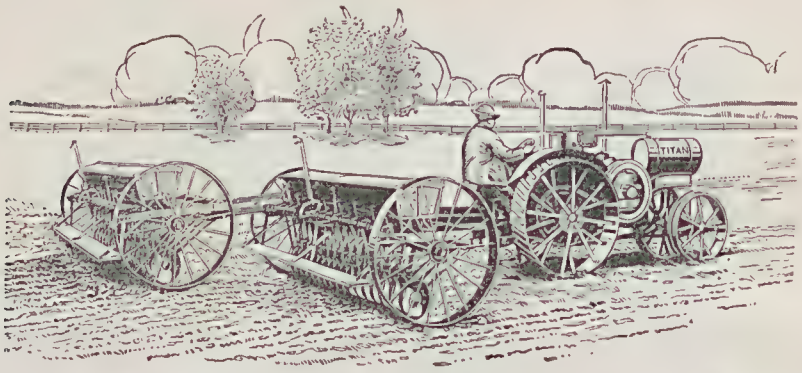

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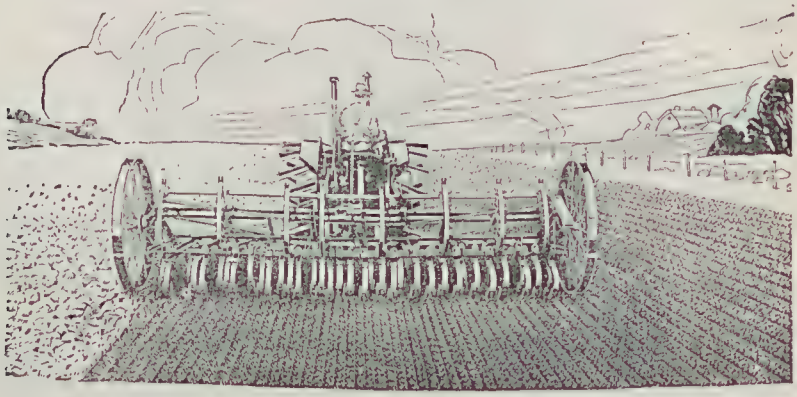


THE JOURNAL

OF THE

Department of Agriculture

OF

VICTORIA.

Vol. XVIII. 15th April, 1920 Part 4.

INCREASING PRIMARY PRODUCTION.

Hon. D. S. Oman, M.L.A., Minister of Agriculture.

Five years ago the Government, through the Department of Agriculture, appealed to the Victorian wheat-growers to sow a record acreage of wheat. The wheat was wanted urgently to help to provide our allies with breadstuffs, and thus help to make certain that the war would not be lost through a shortage of food supplies.

Another call is being made to-day for increased production; its purpose, however, is different. The war has been won, but the war debt remains to be liquidated. Victoria can best meet her share of the debt by increasing her production of all primary products, wool, meat, butter, and especially wheat, for increased production of wheat can be effected more quickly than an increase in meat and wool. The European production of wheat has fallen lamentably short of requirements, and as a result prices have risen rapidly. The present and prospective level of prices is so high that every Victorian wheat-grower should carefully consider and weigh the facts, and shape his plans to meet the new situation that has arisen. Production of breadstuffs in Europe has seriously declined, despite every encouragement in the form of high prices and Government guarantees. It would appear that several years must elapse before Europe can be supplied by the wheat-producing countries with sufficient food to feed the starving populations and maintain normal reserves. Should the new crop in the northern hemisphere prove short of requirements, further increases in price are inevitable. The British Government has maintained the price of bread at 9d. per loaf at a cost of £60,000,000 per annum. The price of imported wheat in Great Britain at the present time has been fixed at 12s. per bushel, but its actual c.i.f. value, based upon open markets and the ruling rate of freight, is considerably higher than this.

Fluctuations in the world's price of wheat are, of course, inevitable, but all the indications are in favour of high prices until normal production is restored. Not only is the world's supply of wheat short, but the world's rice crop has fallen short of expectations, and any surplus from the new Indian crop may have to be diverted to meet Eastern requirements. A good price therefore, seems assured for some considerable time; but, in addition to this, the Government is guaranteeing the farmers 5s. per bushel on the local railway station. Consequently, wheat-growers know before they sow that the price will be profitable. They are therefore urged to bend their energies to the sowing of a record crop during the coming season.

A big acreage under wheat will be a fine asset for Victoria next year. If the season proves to be dry, the harvest may all be required for consumption in Australia, for there will be no wheat left in Australia at the end of the year. If, as is hoped, the season proves favorable, a big acreage will give a heavy crop and a big export surplus, which will realize high prices in the markets of the world.

The present Government stands ready to assist primary producers in every branch of production. Large sums of money have been made available for the establishment of co-operative cool stores, freezing works, canneries, and for the development of the water resources of the State.

A brief *résumé* of some of the Government's activities in assisting primary production may be given. The Wheat Pool has been adversely criticised in some quarters, especially in regard to the supposedly large losses caused by the ravages of mice and weevil in the earlier crops. In point of fact, the net losses have been only 1 bag in 604 bags, or one-sixth of 1 per cent., calculated over the whole of the Pools, and making allowances for the gain in weight and the adjustments made by the British Government for weevil compensation.

The financial results for the five years must be regarded as satisfactory from the growers' stand-point. Allowing for payments made to growers and including present values of wheat scrip, the average realization over five seasons was practically 5s. per bushel f.o.b. for the whole of the wheat received into the Pool in this State.

The growers have asked for a compulsory Pool for the handling of the 1920-21 crop, but the request has not been viewed with favour by the Prime Minister. The Victorian Government stands for co-operation, and if the Co-operative Companies can handle wheat in competition with private enterprise, reasonable assistance might be provided. For the present, the Government is in favour of a continuance of the Pool under existing conditions for another year. In view of the guarantee promised for the next crop, this would seem essential for the safeguarding of the various Governments concerned.

Cool storage facilities have been greatly increased, and over 3,200,000 carcasses of mutton and lamb have been shipped from Victoria since 1st July last, and there are to-day over 1,000,000 carcasses in the cool stores awaiting shipment. Ample provision has been made to meet the situation that had arisen due to the adverse climatic conditions in the State, and huge losses have been avoided and profitable results obtained for stock-owners in the State.

The Government has increased the hanging and freezing capacity in the Government Cool Stores from 8,000 to 30,000 per week during the height of the season, and increased accommodation now being built will provide for 100,000 carcasses of mutton and lamb each week in the flush of the season. When lambs were "ripe" they had to be properly treated. The Government recognised this, and did not hesitate to make ample provision to safeguard the interests of the producers within the State. While cold storage at the Victoria Dock and in fruit stores within the metropolitan area has been provided at a cost of nearly £500,000 sterling, arrangements are being made to provide for the primary producers under an Act passed last session which authorizes advances being made to Co-operative Companies for the handling and treatment of stock near their own pastures.

The following loans have already been made:—

Donald Freezing Works	£55,000
Murtoa Freezing Works	40,000
Sale Freezing Works	11,000
A total of	£106,000

and applications from Bendigo and Ballarat and the Western and Murray companies are at present receiving sympathetic consideration.

It is proposed to apply the provisions of the Dairy Supervision Act to the whole of Victoria. In the districts already under the operation of the Act there has been a notable increase in dairy production, and a reduction in losses of stock by disease. It is anticipated that much material benefit will accrue to the dairy industry through the application of the Act to the whole State. A Cream Grading Act was placed on the statute-book last session, and it will be brought into operation at the earliest possible moment.

Measures to provide equitable compensation to owners of stock suffering from contagious diseases, and for dealing with vermin and noxious weeds, are in course of preparation.

The storage of water to increase production on the lands around Maffra is being undertaken, and it is hoped that the provision of irrigation will result in increased areas being sown to sugar beet in the district served by the Maffra beet sugar factory.

In view of the increased price of sugar, the Government intends paying a bonus of 5s. per ton on all sugar beet delivered to the Maffra factory during the present campaign. This will make the price payable for beets delivered to the factory 35s. per ton. It is also proposed to pay this price for all beets delivered to the factory next year (1921). In order to encourage beet-growing in other parts of the State, it has been determined to carry beets on the railways to the Maffra factory at a cost equal to that charged on beets grown in the Maffra area.

The flax and tobacco industries have not been neglected, and assistance towards the development of these industries is being provided.

No opportunity is being missed by the Government to increase all branches of primary production and in promoting the best interests of the men on the land, for in doing this it is serving the best interests of the State.

DEPARTMENT OF AGRICULTURE, VICTORIA.

1920 WHEAT CAMPAIGN.

A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

I.—Increase Wheat Production.

Five years ago the Government, through the Department of Agriculture, appealed to the Victorian wheat-growers to seed a record acreage with wheat. Food was required to win the war, and foodstuffs were urgently needed to supply the allied armies. The farmers responded to the call and reaped nearly double a normal crop.

Another call for increased production is now being made. It is as urgent as that made five years ago, but its purpose is different. The war has been won and peace with its many problems lies ahead.

The war debt has to be met and eventually liquidated. Australia can best do this by increasing its production of primary products—winning more wealth from the soil. Five years ago the Victorian farmers responded to the call for increased production with fine spirit.

Their response was a crop of 60,000,000 bushels.

The wheat which was raised in 1915 furnished food for the Allies and for our own battalions in France. That was a sufficient reason for making the necessary sacrifices to put in a bumper crop.

The Allied cause triumphed and Australia, in common with her allies, made heavy sacrifices in men and money. The loss of the young men can never be made good. The cost in money may to some extent be recovered by producing a heavy surplus for export.

Impoverished Europe must go without many things during the troublous years ahead, but bread she must have. Europe prior to the war produced half the world's supply of wheat and consumed the surplus of the rest of the world.

Wheat is fetching famine prices in Europe because her production has seriously fallen off during the war and the supplies available outside Europe are inadequate to meet the demand.

The teaching of history goes to show that after every big European war wheat prices remain at high levels for several years after the termination of hostilities. It would therefore be futile to expect cheap bread in Europe for at least several years after the termination of the greatest war of all time.

There is now little doubt that the price of wheat at next harvest will be highly profitable to the grower. The Commonwealth and State Governments have guaranteed the farmer 5s. per bushel net for all wheat harvested this year.

This is of course a guarantee—a minimum price—but the farmer may receive considerably more than this minimum. He will in fact get full world's parity for the whole surplus, but whatever happens he is assured a minimum of 5s. per bushel.

The wheat growers, therefore, are in the happy position of knowing before they sow the crop that the price at harvest will be profitable, and they are urged to bend all their energies to the seeding of a record acreage during the coming season. A heavy crop will give a big exportable surplus which will realize high prices abroad. This will materially assist the nation in meeting its heavy war expenditure, and will be a source of great profit to the growers.

Wheat will pay war debts.

Wheat will lift the mortgage.

Wheat will profit the grower.

Therefore, sow a record acreage.

II.—The Wheat Growers' Great Opportunity.

There has been a serious shortage in breadstuffs in Europe during the past year. The causes are many. The man-power of the warring nations has been mobilized for war service, and those of neutral nations for manufacturing materials for prosecuting the war. Europe's greatest wheat field, Southern Russia, has been in the throes of a civil war for the past two years. In many countries the climatic conditions have been highly unfavorable for heavy wheat production.

The teaching of history tends to show that the close of all big wars usually ushers in a prolonged period of high prices for foodstuffs. The recent trend of wheat prices indicates that history will again repeat itself.

The production of most of the European nations, despite Government encouragement and the assurance of high prices, has fallen lamentably short of pre-war standards.

France, for example, produced 320,000,000 bushels of wheat before the war. Last year the crop amounted to 168,000,000 bushels—barely more than half. Italy's production last year was 160,000,000 bushels compared with 214,000,000 bushels in 1913.

Nothing definite is known regarding the position in Russia and Roumania, which produced approximately 900,000,000 bushels before the war. Owing to the destruction wrought by the civil war in the former country, and by the Germans in the latter, it is certain that the harvests will fall far short of the pre-war standards.

The American farmers were induced last year by a guarantee of high prices (9s. 2d. per bushel) to seed an enormous acreage of wheat. In July last it was estimated that the crop would yield 1,160,000,000 bushels. Latest advices show that it actually yielded 960,000,000 bushels. The acreage under crop in the United States this year shows a serious reduction in area.

During the war Australia's wharfs have been heavily choked with wheat. At one period the accumulations of wheat were so great and the shortage of shipping so acute that it appeared as if years must elapse before the wheat would be shipped. From many quarters farmers were then advised to curtail their wheat areas and substitute sheep raising for wheat growing. The position has now entirely changed. The drought which afflicted Australia last year resulted in a crop which was barely more than sufficient for Australia's requirements. Overseas shipping has increased to such an extent that the whole of Australia's surplus will be removed within a few months.

It appears certain that several years must elapse before Europe can be supplied by the wheat-producing countries with sufficient food to feed the starving populations and maintain normal reserves.

Should the crop harvested in the Northern Hemisphere from July to September fall short of requirements, further increases in price appear inevitable. Australia will not be in a position to substantially benefit from improved markets until January of next year, because her exportable surplus is practically all sold.

With a good season and a big acreage under crop, Australia will be in a fine position to meet her pressing financial obligations caused by the war by disposing of her surplus at favorable prices. What a fine asset would 100,000,000 bushels of unsold wheat be at the present time.

The Australian farmers have not been spoon-fed during the war. Wheat prices in other countries have been at least double or treble the price in Australia. Despite this, production in these countries has not increased.

The Australian farmer, with his labour-saving machinery and large areas of land, can produce wheat as cheaply as in any part of the world. It appears as if he is now coming into his own.

Will he take full advantage of the possibilities by seeding a record acreage with wheat. The price of every bushel he raises will be at least 5s. net on the local railway station. The State and Federal Governments have guaranteed him this. His wheat may, however, be worth a great deal more, because it will realize full world's parity, and there is every indication that the parity will be high.

In 1915 farmers sowed a record "War Crop" to help the Allies.

In 1920 they should sow a "Peace Crop" to help the State and themselves.

III.—A Peace Crop of Four Million Acres.

During the war the area of wheat has steadily declined in Australia. The decline was very marked in all States. These are the figures for Australia:—

Season.	Area under Crop, Australia. Acres.
1914-15	9,651,081
1915-16	12,484,512
1916-17	11,532,828
1917-18	9,774,659
1918-19	7,993,238

In five years the acreage has fallen from the record of twelve and a half million acres in 1915-16 to eight million acres last year. This, perhaps, might have been expected when we review the circumstances. Many causes operated to bring about the decline. Scarcity of labour, higher costs of production, low prices, and unfavorable seasonal conditions were mainly responsible for bringing about this decline in acreage and in yield. Scarcity of labour became most pronounced after 1915, when the country-side was drained of its youth by war's insistent call.

The marketing of Australia's harvests proved to be a task of immense magnitude, the difficulties of which were accentuated by scarcity of freight, damage by mice and weevil, and lack of suitable storage facilities and the piling up of surplus on surplus. The general result was that many of the farmers who cultivated large areas either reduced their acreage or went in entirely for sheep. The wheat grower with limited acreage was practically compelled to continue wheat growing, as his acreage would not provide an adequate living if his farm were merely grazed with sheep.

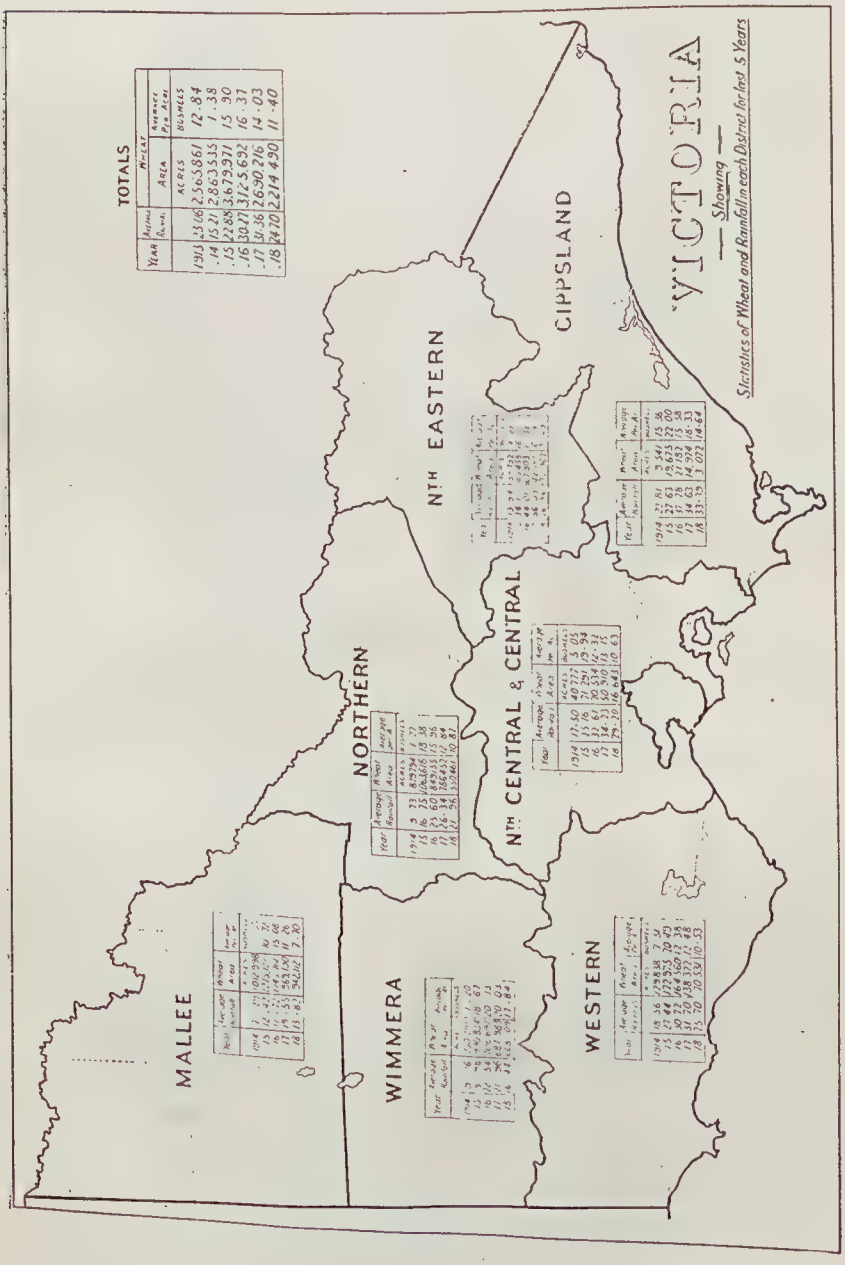
The net result was a shrinkage of four million acres under crop for Australia, and of 1,400,000 for Victoria.

The following table shows the extent to which Victoria was affected:—

Season.	Victoria. Acres.	Production. Bushels.
1914-15 ..	2,863,535 ..	3,940,947
1915-16 ..	3,679,971 ..	58,521,706
1916-17 ..	3,125,692 ..	51,162,438
1917-18 ..	2,690,216 ..	37,737,552
1918-19 ..	2,214,490 ..	25,239,871

In 1915 the Victorian farmers were urged by the Government to put in four million acres. The actual area sown was 4,160,000 acres, of which some 450,000 acres were cut for hay. This big acreage was sown despite many disabilities—scarcity of labour, loss of stock through drought, and uncertainty regarding the future. To-day the farmers are urged to put in a Peace Crop of four million acres. With favorable autumn rains this goal should be possible. This is how such an acreage might be secured:—

Of the normal acreage sown to wheat, namely, two and a half million acres, 1,600,000 acres are sown on fallowed land and about 900,000 acres on autumn ploughed land which bore grass, hay, or forage crop the year before. At the present time, approximately 1,700,000 acres are in fallow. We may expect that the normal area of 900,000 acres of hay


VICTORIA
— Showing —
Statistics of Wheat and Rainfall in each District for last 5 Years
MALLEE
WIMMERA
NORTHERN
WESTERN
NTH CENTRAL & CENTRAL
NTH EASTERN
GIPPSLAND
TOTALS

land will be sown. During the past year one great wheat province—the Mallee—suffered a comparative failure. Many parts of the Goulburn Valley and Northern District bore but stunted crops. Of the two and a half million acres sown last year, at least from two-fifths to one-half of the stunted crop areas could, with comparatively small expense, be worked up and got ready for autumn seeding. This would give an addition of 1,100,000 acres. For virgin land and induced extra sowings by large farmers and farmer-graziers we may add 400,000 acres. This would give a total of four million acres.

Whether such an increase will be obtained depends largely on the weather conditions during March and April, and to a lesser extent on the availability of farm labour and the credit which the farmer may secure from financial and business houses.

It is a truism in regard to weather that "What has been will be," and if we have had cycles of good seasons in the past we may confidently expect them in the future.

Unfortunately, meteorological science has not progressed far enough to enable reliable long-range weather forecasts to be made with confidence; nor does a survey of past records of Australian rainfall reveal any regularity in the sequence of good and bad seasons. But this much does seem to be true as regards Victoria—that our really droughty years are followed by a year of exceptional productivity. This was notably the case after 1888, 1902, and 1914, three of the driest seasons in Victoria's history. The remarkable recuperative powers of the soil after a drought are well known. The enforced rest from crop production enables plant food to be formed in the soil; and even a moderate rainfall in the following year results in a good crop. Even with a moderate rainfall a Peace Crop of four million acres will be a big post-war asset to meet the State's obligations.

Victoria's Peace Crop of Four Million Acres.

1. Land already fallowed ...	1,700,000	acres
2. Normal area sown after hay, forage, and grass ...	900,000	acres
3. Working up of two-fifths of the stunted crops of 1919 ...	1,000,000	acres
4. Extra sowings by farmer-graziers	400,000	acres
	4,000,000	acres

Farmers and Land Owners should see to it that the above acreages are got.

The Influence of War on Wheat Prices.

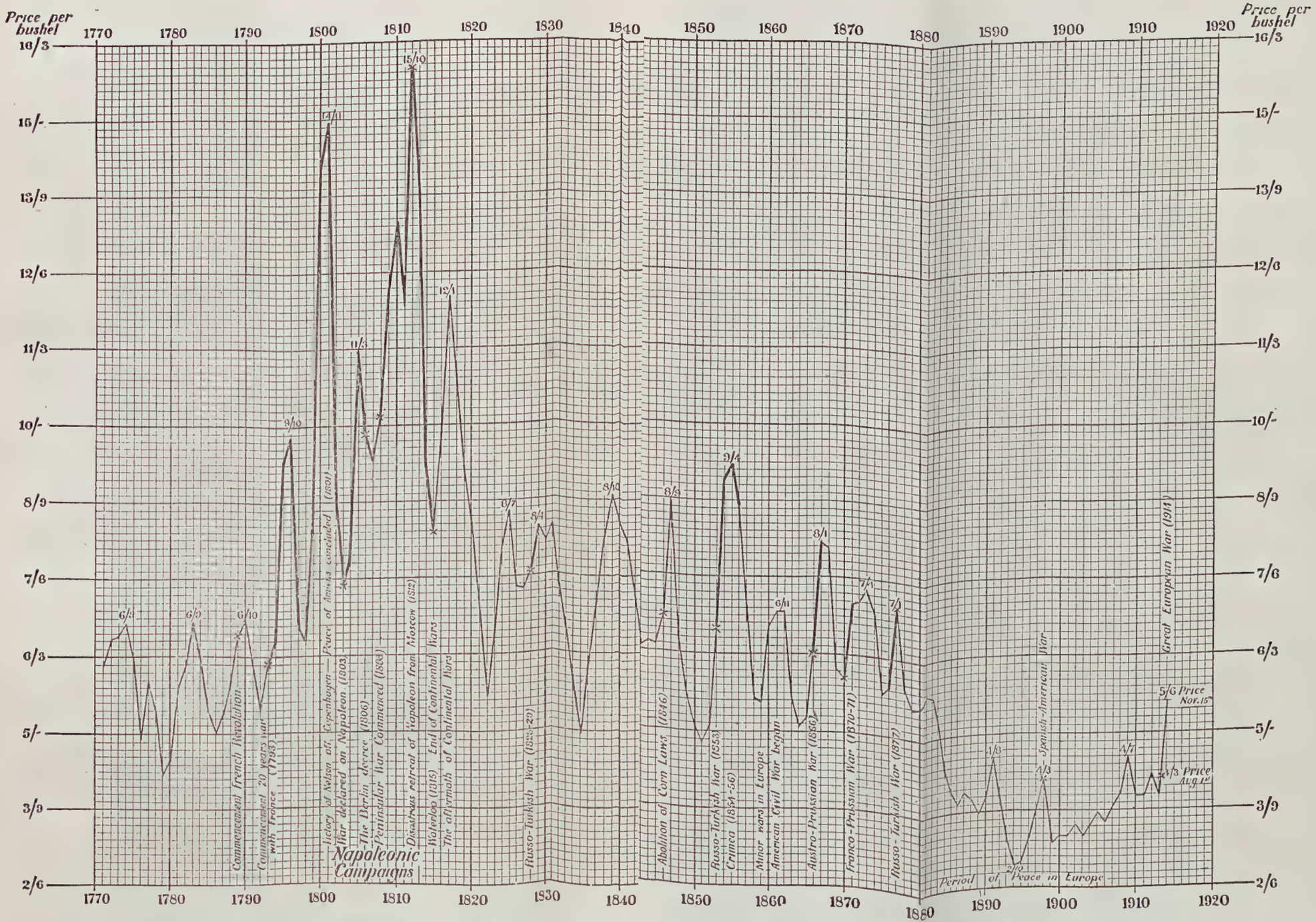


CHART SHOWING AVERAGE ANNUAL PRICE OF BRITISH WHEAT PER BUSHEL FOR THE PAST 150 YEARS.

4306.

IV.—The Influence of War on Wheat Prices.

The accompanying chart shows the average price of wheat in Great Britain for the past 150 years. It shows the influence of wars on wheat prices. A careful inspection of the graph will bring out the following general facts:—

1. In times of war prices fluctuate violently and on the whole are relatively high.
2. In times of prolonged peace the fluctuations are slight and prices are relatively low.
3. In the European wars of the past century the prices of wheat remained at high levels for several years after the declaration of peace.

During the Napoleonic wars the price of wheat reached 15s. 10d. per bushel. At the beginning of the Crimean war wheat was selling at 5s. per bushel. Two years later it rose to 9s. 0½d. per bushel, and remained at that price for three years.

During the Franco-Prussian war (1870-71) the price of wheat rose from 5s. 9d. to 7s. 4d. per bushel, and remained at this latter figure for three years after the declaration of peace.

What will happen after the greatest war of all time?

Prices of wheat were high during the war period, but they are now rapidly rising. Will history repeat itself? Will prices remain at high levels for several years after the conclusion of hostilities?

It looks as if the answer must be YES.

During the war, the British Government fixed the price of wheat at from 7s. 6d. to 8s. a bushel, to enable bread to be sold to the public at 9d. per loaf. It was recently reported that the subsidy required to make up the difference between these values and the actual cost of the wheat amounted to £60,000,000 per annum. This is an extremely heavy burden on the Treasury, and it was not surprising to learn that the fixed price of wheat had been raised to 12s. per bushel (March, 1920).

Even this figure (12s. per bushel) does not represent the actual cost to the British Government. The approximate c.i.f. cost of wheat, based upon current freights and f.o.b. prices for wheat in Argentina and America, would be about 16s. per bushel.

History shows wheat prices soar after every war.

Will History repeat itself? It always does.

Sow a big acreage to wheat.

WHEAT AND ITS CULTIVATION.

1.

A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

Ever since the dawn of history civilized man has used wheat as a staple article of diet; and, in competition with foods of other races, it is displacing rice, millet, and other grains to such an extent that its production has become one of the most fundamental problems of the present day.

No problems in the realm of agriculture should be of greater moment than those relating to the production of our daily bread. Particularly is this true with respect to Australia, for the prosperity of her people and the stability of her finances are in a very large measure dependent on the success of her wheat harvest. The world's normal production of wheat is approximately 4,000 million bushels. Of this vast quantity, Australia's normal contribution is but 2½ per cent. Although the wheat industry of the Commonwealth has made enormous progress during the past twenty years, it will be a long time before Australia's production will exert any appreciable influence on the price of wheat in the great markets of the world.

World's Wheat Production.

Europe produces over half the world's wheat supply, but her population is so great that she consumes the world's surplus in addition to her own crop. The world's great wheat fields are generally sufficiently level to allow the use of big machinery, both for tillage and harvest. There are eight important centres of wheat production in the world:—

1. The plains of Southern Russia and the Valley of the Danube.
2. The countries bordering on the Mediterranean.
3. The plains of North-Western Europe.
4. The central prairies of United States of America and Canada.
5. The Columbia River Basin of the United States.
6. North-Western India.
7. The pampas of Argentina.
8. Southern Australia.

Of these areas, the Mediterranean countries and North-Western Europe export no wheat; because of their dense populations there is a heavy local demand.

In five of the six remaining regions of surplus production the population is sparse, the type of agriculture extensive, the land relatively cheap, and wheat is free from the competition of more productive crops.

The following table gives the average annual production of wheat in the more important wheat-grown countries for the five years prior to the war:—

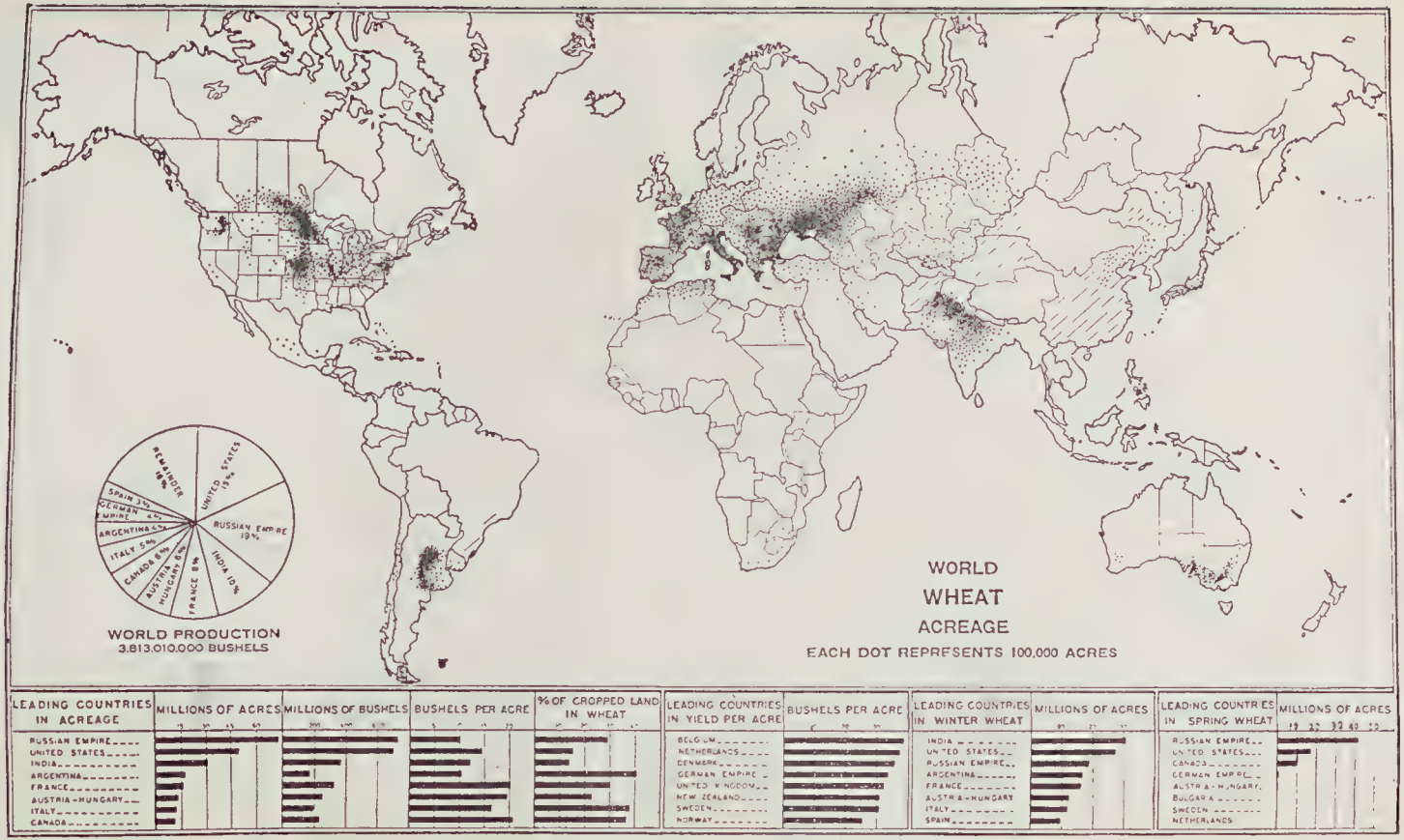
	Million bushels.
Russia	817
United States of America	685
India	350
France	317
Austria-Hungary	232
Canada	197
Italy	188
Germany	152
Argentina	148
Australia	91

The Russian wheat belt is one of the largest fertile regions of land in the world. The predominant soil is the black earth, or "chernozium." It is an immense arable plain of great uniformity, and is extremely rich in organic matter. It extends from Bessarabia to the Ural Mountains. The low average yield is due partly to the primitive methods of agriculture, the ignorance of the peasants, and the somewhat erratic rainfall. The future possibilities of Russian wheat production largely depend on the social, economic, and educational progress of Russia. Russia hitherto has lacked the institutions necessary for progress and prosperity, and many of the peasants live in ignorance, poverty, and misery. Since the construction of the great transcontinental railway through Siberia, the productive power of Asiatic Russia has become a matter of vital interest. Siberia is nearly twice the size of Australia, and has large areas where wheat could be grown. What part Siberia will play in the development of the wheat industry will depend upon the social and economic development of Russia. It is fairly certain, however, that the production of wheat in Siberia will be one of the permanent factors in the wheat industry of the world.

The greater part of the wheat of the United States is produced in the Central Prairies and the Valley of the Mississippi. Kansas, the Dakotas, and Eastern Washington are the three centres of densest production. In these districts the average rainfall varies from 15 to 30 inches. The opening up of the American and Canadian prairies gave a great impetus to wheat production, and led to a lowering of price in the world's markets. American production has, in the past, been a big factor in the world's wheat market, but her population is growing so rapidly that it is probable that she will cease to be an exporter of wheat within another decade.

Canada's wheat is chiefly grown in the three great prairie provinces—Saskatchewan, Manitoba, Alberta. It is estimated that there are 150 million acres upon which wheat could be profitably grown. Owing to the cold winters, the bulk of the crop is spring sown, but winter wheat is grown in Ontario and Alberta. The wheat belt of Western Canada is limited on the north by the short growing season, and on the south by the erratic rainfall.

The wheat belt of India lies in the north-west—the region of greatest extremes of temperature—and three-quarters of the total wheat is produced in the north-west provinces. Wheat ranks third among



Map of the World showing Distribution of the World's Wheat Acreage. (From U.S. Department of Agriculture.)

the crops of India, being exceeded in production by rice and grain sorghums. In the Punjaub, nearly half the wheat is grown under irrigation. The wheat is usually sown in October, after the monsoon rains, and is harvested from February to April. India consumes nearly all the wheat she produces.

The Argentine has an enormous area of flat fertile land and a climate which permits the land to be worked during most of the year. It is estimated that ultimately 60 million acres of land will be devoted to wheat growing. The Government of Argentina has carried out a vigorous immigration policy, which prior to the war yielded over 100,000 immigrants per annum. The agricultural methods are, at present, very primitive, and the yield per acre low. Argentine is bound to become a big factor in the world's wheat market, and will be Australia's greatest competitor, for the crops of both countries come on to the world's markets simultaneously.

Australia's proportion of cultivated land under wheat is the highest in the world. The greater part of the wheat is produced on an annual rainfall of 12-25 inches. The inner margin of the wheat belt is determined by aridity, and the outer limits by humidity and mountain topography. In 1917-18, 68 per cent. of the total area under crop was sown to wheat, that is to say, of the 14,298,982 acres cultivated in the Commonwealth, 9,774,658 were devoted to wheat.

The man in the street naturally seeks some explanation for the extraordinary popularity of this cereal, and under the existing economic conditions convincing reasons are readily forthcoming. Wheat is an excellent pioneer crop, and it lends itself admirably to the *extensive* system of farming common to all comparatively new countries, where, compared with densely-populated countries, land is cheap, and individual holdings being considerable, high class farming is rarely practised, and the object of the cultivator is rather to secure a small average return from an extensive acreage than a large average return from a small area. With our multiple-furrow ploughs, 20-tine cultivators, and 4-horse drills, large areas can be cultivated with the minimum of hand labour, and the complete harvesters enable the grain to be taken off with the greatest facility. With the increase of population, and the inevitable increase in land values ahead of us, this system of farming, particularly in Victoria, will gradually be modified, and a new era will be ushered in, characterized by smaller areas under individual cultivation and higher averages per acre.

Under existing conditions of cultivation, it does not require the exercise of much skill, or of a great deal of labour, to secure a *payable* crop of wheat, though it does require the very highest skill, ability, and intelligence to secure the maximum crop the soil and season will allow.

As long as the wave of expansion continues in Russia, Canada, Argentine, and Australia, enormous supplies will be raised for many years to come under pioneer conditions—under conditions of extensive farming—and it is owing to the capacity of these countries during the last generation for raising cheap wheat that wheat is being displaced from its position in the rotation systems of highly farmed and densely populated countries.

An additional reason for its popularity lies in the fact that for wheat there is always a ready market, and that, unlike many agricultural products, it does not suffer by storage or transportation over long distances.

Moreover, it is a most reliable crop, especially when treated in a rational manner, and, being more resistant to drought than any of the other cereals, it is more likely to succeed under arid Australian conditions than other crops.

Finally, during the decade prior to the war, prices were satisfactory, and the standard of efficiency in wheat cultivation has been considerably raised by the recognition of the value of fallowing, judicious crop rotation, rational soil cultivation, and systematic manuring. The wheat farmer has, therefore, greater confidence in the future, for he feels that he knows more of the essentials for successful cropping than he did a decade ago.

Future Production of Wheat.

Malthus, after a study of the respective rates of increase of population and the world's food supply, came to the conclusion that the rate of population tended to increase faster than the means of subsistence, *i.e.*, that population tended to increase in geometrical progression and the world's food supplies in arithmetical progression. Hence the time was not far distant when there would be a general scarcity of foodstuffs for mankind throughout the world. Ever since Malthus' time there have been periodical predictions of approaching famine for the human race. One of the most striking of these was that of Sir William Crookes, President of the British Association for the Advancement of Science. Crookes predicted that on account of the rapid increase of population a serious shortage in the supply of wheat would exist in 1931. He made this prediction largely on the assumption that by this date the supplies of nitrogenous fertilisers from Chili and Peru would be exhausted. Barely had his prediction been made when a process for fixing nitrogen from the air was discovered. Nitrogenous fertilisers are now manufactured in immense quantities from the nitrogen of the air.

Most of the prophecies over-emphasise the numerical increase in population, and fail to give due regard to the laws which control the production of food and its ratio to population. They also overlook the great possibilities for increasing the acreage under wheat and increasing the yield per acre. A scarcity of wheat merely leads to an increase in price, and this is followed by an increase in production. In time of war there may be an acute scarcity of foodstuffs and a serious world shortage, but in normal times a general and acute world shortage of foodstuffs is almost impossible, for whatever the standard of living, population will limit itself long before acute conditions are reached. A threatened shortage increases prices and encourages further production, and production is gradually adjusted through the medium of prices to the requirements of the population. We have already seen that the great wheat belts of the world are by no means fully exploited, and that there are immense areas which have not yet felt the plough. In Australia we know that the existing acreage under wheat could at least be trebled, and that the yield per acre could be increased by 50 per cent. if world circumstances required it. Capital, labour, and settlers will be available when world prices are high enough to encourage the tillage of our poorer lands.

The wheat industry of the world must undergo immense developments before even its approximate limits can be defined.

Wheat Production in Australia During the War Period.

During the war the production of wheat in Australia has declined. During 1915 special efforts were made by various Governments and Departments of Agriculture to secure a large acreage under crop. The area sown in 1915 was a record for Australia, but for various reasons the succeeding years showed a rapid decline in acreage and in aggregate production.

The official statistics of production for the war period are summarised in the following table:—

Table I.—Area under Wheat in Australia during the War.

Season.	Victoria.	N.S.W.	S.A.	W.A.	Commonwealth.
	Acres.	Acres.	Acres.	Acres.	
1914–15 ..	2,863,535	2,746,343	2,502,630	1,376,012	**9,651,081**
1915–16 ..	3,679,971	4,186,493	2,739,214	1,734,117	**12,484,512**
1916–17 ..	3,125,692	3,805,699	2,778,357	1,566,608	**11,532,828**
1917–18 ..	2,690,216	3,328,856	2,355,682	1,249,762	**9,774,658**
1918–19 ..	2,214,490	2,410,530	2,186,349	1,145,408	**7,993,238**

Many causes doubtless operated to bring about this decline in acreage. Scarcity of labour, rising costs of production, unfavourable seasonal conditions, and relatively low prices were the main factors. The general result was that many of the farmers who cultivated large tracts either reduced their acreages or went in entirely for sheep. The wheatgrower with a limited area was practically compelled to continue wheat-growing, as his acreage would not provide an adequate living if the farm were merely grazed with sheep. The net result was a considerable diminution in the area under crop, which was greatest in New South Wales, where wheat farms were larger than the other States, and where the disturbing factors were most pronounced.

The marketing and financing of Australia's wheat harvests proved to be a task of immense magnitude, the difficulties of which were accentuated by scarcity of freight and lack of suitable facilities for storing grain for prolonged periods. Ravages of mice and weevil added greatly to the difficulties of administration, and caused immense losses, which eventually had to be borne by the growers.

During the war the cost of production increased rapidly; labour, machinery, implements, fertilisers, bags, transport, all increased in price, yet these increased costs were not reflected in materially increasing wheat prices during the war period. The seasons became less favourable from 1915 to 1919, culminating in 1919 in a severe drought throughout New South Wales, Queensland, and Northern Victoria. With the earlier crops the realisation of the harvest was of necessity a slow process, and payments to farmers were spread over several years, and even at the present time (1920) none of the wheat "pools" has yet been wound up. In view of all these circumstances a decline in acreage was almost inevitable. Indeed, during 1918 and 1919 considerable discussion took place as to whether, in view of the small profits in wheat-growing and difficulties in securing labour, the grower should not abandon wheat for sheep.

The Future of the Wheat Industry in Australia seems Assured.

Better times, however, appear to be ahead of the wheat-growers. The world is passing through a period of reconstruction, and higher prices for wheat seem assured.

In an article on Wheat and the War, published in December, 1914,* I made a survey of the effects of European wars on the price of wheat, and showed that during the past 150 years wheat prices rose to high levels during the currency of a war, and remained high for several years after the declaration of peace. It was further stated that it was unlikely that the price of wheat in Australia would be below 5s. during the war, and that wheat would rise in price after the declaration of peace. These forecasts have been confirmed. The price of wheat for local consumption in Australia has been fixed at 7s. 8d. per bushel for 1920, and wheat for export (March, 1920) is bringing 11s. 3d. per bushel. Wheat is selling at famine prices in Europe. Europe normally produces half the wheat of the world, and consumes the surplus of the rest of the world. Impoverished Europe must go without many things during the troublous times of reconstruction, but bread she must have. The surplus of the exporting nations is relatively small, and the acreage is not being maintained. It would therefore be futile to expect cheap bread in Europe for at least two to three years after the termination of the greatest war of all time.

In the industrial and social reconstruction going on throughout the world, and particularly in Europe, it is to be expected that wages will rise, hours of labour will be shortened, and conditions generally will be made more favourable for the worker. If this should come about Australia will be better able to meet competition of other wheat-growing nations, for her workers have always enjoyed favourable industrial conditions and a reasonable standard of comfort. The wheat industry of Australia is in its swaddling clothes. It will not assume the toga of manhood until the pressure of our own population and an increase in the world demand for wheat compel us to conquer our extensive semi-arid areas, and to intensively work the wheat areas already occupied.

In subsequent articles some of the more important phases of the wheat industry will be discussed, including problems relating to cultivation, seeding, fertilisation, harvesting, and marketing, the insect and fungoid diseases affecting the crop, and the directions in which the wheat industry in Australia must inevitably develop.

**Vide Journal of the Department of Agriculture, Victoria*, December, 1914, "Wheat and the War." A. E. V. Richardson, pp. 708-724.

A Regular System of Rotation of Crops is a Feature of the Advanced Forms of Agriculture.

POST-WAR RECONSTRUCTION.

HOW THE FARMER MAY HELP.

H. A. Mullett, B. Ag. Sc., Chief Field Officer.

Why Increased Production is Necessary.

There is no doubt that the average man, whether he be farmer, clerk, or artisan, finds it is much more difficult to make ends meet to-day than before the war. But more disquieting still is the fact that each day sees the difficulty intensified; indeed, no one can forecast with any degree of certainty just when a stable condition will be reached, let alone a return made to normal.

All sorts of theories have been advanced to account for the decline in the purchasing power of money, but probably the real truth of the matter is that the supply of goods available is not sufficient to meet the wants of the people.

It must be obvious that half the nations of the world could not turn aside from peaceful production to engage in a work of unprecedented destruction for four years without having eventually "to foot the bill."

Just to the extent that labour, capital, and energy have been diverted from the normal requirements of mankind for the purpose of organized destruction of the enemy (and incidentally of the landscape and of goods generally) so will the people of the world have to work *overtime* to make good the deficiency. It would probably not be difficult to calculate how many hours of labour have thus been diverted from the ordinary channels, and were it known, it might be possible to determine how long it would take to make up the leeway upon a given basis of extra work.

The people to-day are therefore faced with the necessity of either drastically simplifying their wants or of making, for a time at any rate, better use of their labour than hitherto. It should not be beyond the wit of man to prevent the comfort of the average person suffering ruthless retrenchment.

Any method that may be devised will, however, involve increased production on the part of the individual, and the obligation rests equally on every section of the community, including the man on the land.

Increased Production an Immediate Personal Benefit.

Apart altogether from the benefits that will assuredly accrue to the nation if the people can be aroused to a sense of their responsibilities, there is to the farmer an immediate personal advantage in putting forth his best efforts during the next few years.

Take the wheat-grower, for instance. During the war wheat has been selling at high prices in Europe, yet the Australian grower was unable to take advantage of those prices owing to the high freights and shortage of shipping.

It was confidently predicted that it would take four or five years to ship overseas the large quantities of wheat stored here, and that the farmers would not be fully paid up for years; yet the stacks have been removed at such a rate that the State recently had to carefully husband her remaining stocks in order to meet her own bread requirements Meantime the price of wheat has reached 7s. 8d. per bushel.

There is no doubt that the buoyant condition of the world's wheat market will not last for ever, but there is every reason to believe it will last for four or five years. Should not the farmer therefore consider carefully whether he would not be wise to "make hay while the sun shines."

The wool-grower is in a similar position. Wool is now selling at prices unheard of previously; they cannot last for ever. Would it not be wise to take the fullest advantage of them while they remain?

Once the benefits that are likely to accrue from a national and from a purely personal point of view, as a result of increased individual effort are admitted, it then becomes a question of ways and means.

How may the wheat-grower profitably raise more bushels of wheat, and how can more sheep be carried on each acre?

Tractor at Work.

INCREASING THE WHEAT YIELD.

Sow an Increased Acreage.

The most obvious way of increasing the total yield of grain on any farm is, of course, to extend the area under cultivation.

It is safe to say that the area sown to wheat in this State could be profitably doubled in a single season were the rural community so minded. The farmers responded magnificently after the 1914 drought when called upon to do so in the interests of "Winning the War." Why should history not be repeated after the drought in 1919 in order to "Win the Peace?"

In many districts, as in 1915, there is much "compulsory fallow," which grew only a stunted fallow, last year, which could be worked up and sown as well as the usual acreage.

Many large farmers and graziers in the wheat belt do not realize the advantages of the "share system" in profitably utilizing additional portions of their land. Provided the owner has horse feed available it should not be a difficult matter this year to secure the necessary labour. Both the owner and the share-farmer find this class of cultivation profitable because the owner on the one hand is relieved of the

usual responsibilities involved in seeding the extra area, while the latter, sharing in the profits, has every incentive to make the best use of every minute of his time. The result is a gain to owner, farmer, and the State.

Farm Each Individual Acre Better.

Of far greater importance to most farmers, perhaps, than increasing the total area cultivated, are methods of increasing the yield of each acre sown. In every district are to be found the good and the indifferent farmers, and, unfortunately, the latter are by far the more numerous. The problem of increasing production would largely be solved if the whole of the yields could be raised to the level of those of the best men.

Perhaps the chief reason for the wide differences found lies in the fact that most are naturally unwilling to face the unpleasant fact that

A Heavy Crop of Penny Wheat Grown in Kiata East in 1919. Rainfall, 6 inches during the growing period. 1 cwt. of superphosphate and 1¼ bushels of seed were used to produce this ten-bag crop.

their methods are inferior, without greater proof than there is opportunity for demonstrating on the average farm.

During the past ten years, however, systematic investigation has been undertaken as to the reasons why some methods are better than others, and it is possible in many cases to say *how much* they are better in an average year.

Besides this comparison of existing methods, innovations have been carefully tested against the old systems.

As the result of this work, it is now possible to present an epitome of the best methods of growing wheat and to submit definite figures in justification of the practices advocated. In many cases it has been found possible to reduce the advantages of certain methods to terms of hard cash.

To put the matter in a concrete form, what the farmer wants to know is how best to prepare the land, what variety of wheat to sow,

how much of it should be sown per acre, when it should be sown, how much manure should be used, &c., all of which, as he is well aware, have an important financial bearing on the results. He also knows that conditions vary to a certain extent in different districts, therefore, he wants the results which are likely to be applicable under his own peculiar circumstances.

Working the Fallow.

Without a doubt, the greatest factor in the production of a maximum crop of wheat is the character of the fallow. The object of fallowing goes far beyond the preparation of a good seed bed, the killing of weeds, or the profitable utilization of the farm labour. These are the obvious results of the practice. The most important point of all is, however, not visible to the naked eye. It is the provision of the maximum supplies of water in the sub-soil for the growing crop. By early fallowing and by carefully working the fallow, it has been found possible in the

Heavy Dressings of Fertilizer Lift Oat Yields in the Wimmera. No manure on left—90 lbs. superphosphate on right. Observe height, quality, and thickness of fertilized crop.

wheat belt to preserve portion of the rainfall from the year before for the use of the current crop. In this way the best farmers are able to conserve moisture equivalent to 3 or 4 inches of rain for use of their crops than the indifferent farmer. This extra moisture means several bags more wheat to the acre.

July fallow is better than September fallow throughout the length and breadth of the wheat belt. Fallow early and fallow well should be the watch-word. In the Mallee and in the Wimmera the friable soils should be worked after every rain, so that a loose mulch of soil may be maintained. A hard cracked surface must be avoided. In other districts, however, the soil readily cakes together, hence it must never be allowed to get too fine. It will not stand so much cultivation. Leave it cloddy; never caked. In all districts avoid dry working of the land as far as possible.

Varieties to Sow.

Federation wheat is the popular variety in the Wimmera, the older Mallee, and Northern Districts, and rightly so. Comparative tests at

Longerenong College have shown that ordinary Federation gave an average yield of 4 bushels to the acre more than the next best standard variety, Yandilla King, and 6 bushels to the acre better than Darts Imperial. Where Federation seed had been specially selected each year a further increase of nearly two bags to the acre resulted on the average as compared with ordinary Federation.

These three varieties are superior to numbers of others that are sown on some farms in these districts, the continued use of which must result in serious loss to the farmer.

In practice on the average farm the seeding season is often spread over several months. When this is the case it will not pay to pin faith on even such a prolific variety as Federation.

For very early sowing a slow maturing variety like Yandilla King will do better than Federation, and for that portion of the seeding which is made unduly late a quick growing variety like College Eclipse is preferable.

For the Wimmera and older Mallee, Penny, a variety not yet tested at Longerenong, has held its own with Federation, particularly in the Nhill district, where it was introduced several years ago. The new crossbred, Gallipoli, raised by the Department of Agriculture, has established itself as a wheat of high-yielding powers. It is short-strawed and holds its grain well.

In the Werribee District, Federation is outclassed by such wheats as Marshall's No. 3, Yandilla King, Penny, and Currawa. Currawa, for instance, has averaged a bag to the acre more than Federation over the five years 1913-1917. At Rutherglen, Yandilla King, Marshall's No. 3, and Federation have outclassed all others. In the newer Mallee, Mac's White, Dart's Imperial, Federation, and Currawa have done well.

Having selected the variety it is highly important to secure a high-yielding strain. All wheats tend to "run back." Growers should, therefore, make sure that the seed used has been obtained from a seed station within recent years.

Rate of Seed Per Acre and Time of Sowing.

In all districts except on the black soils of the Wimmera, early sown crops are, on the average, the best, other things being equal. In districts where the winter is very wet and the soil sets down, sow in April, if possible.

In most other districts sow in May. On the black Wimmera plains the sowing may, in average years, be deferred till June and even July with advantage to the crop.

Indeed, the results of five years' investigations at Longerenong show that July sowings were about 2½ bushels to the acre better than June sowings, though, this year June sowings were nearly three bags to the acre to the good.

Closely connected with the time of sowing is the most profitable rate of seeding.

For many years, 45 lbs. per acre has been accepted as the standard sowing for Mallee districts and 60 lbs. elsewhere, but the modern tendency is to increase these amounts. In the Mallee the sowing of a bushel to the acre is now becoming usual, and an excellent crop was seen this year on Mallee land near Dimboola, which had been sown at the rate of 1½ bushels of seed to the acre. In the Wimmera 75 lbs. of seed

per acre is now common practice, and tests on the experimental plots at Longerenong during the past five years have demonstrated that, for July sowings, if 75 lbs. of seed per acre is sown instead of 60 lbs., the extra 15 lbs. will cause an average annual increase of no less than 4 bushels to the acre. These facts are significant. In a general way, the earlier the sowing the lighter the seeding, and the later the sowing the heavier the seeding that should be used.

Fertilizers.

On the subject of manuring a mass of reliable information has been collected. Tests right throughout the wheat belt have demonstrated that superphosphate by itself is the most profitable manure to use for wheat.

It has been conclusively proved that the average farmer systematically starves his soil of phosphates, and that he puts on only about half the most profitable dressing.

The following are the results of the manurial tests this year in the newer Mallee districts, where the rainfall from 1st May to 30th November averaged only 80 points per month, or 5½ ins. in all.

The plots were sown towards the end of May with 45 lbs. of graded Federation wheat, with varying quantities of superphosphate per acre, as under. The yields are in bushels per acre:—

Results, 1919.

Treatment.	Cowangie.	Carwarp.
No Manure	9.5	6.3
30 lbs. Superphosphate	12.2	8.6
60 „ „	15.5	11.2
90 „ „	16.6	12.5

The yields obtained this year are a striking testimony of the fertility of the Mallee country, even in a dry year, when properly fallowed and manured.

What these results mean in hard cash to the Mallee farmer is best seen by reference to the balance-sheet, which has been prepared with the object of showing just what extra profit per acre has resulted in each case from the application of the various dressings of manure tested. The wheat has been valued at the low rate of 4s. a bushel, and the superphosphate at £5 per ton. The figures are on the basis of 1 acre as a unit:—

Cowangie.

	Increase.	Value at 4/- per bush.	Cost of manure.	Net Profit Per Acre.
No manure	—	—	—	—
30 lbs. super.	2.7	10/9	1/4	9/5
60 lbs. super.	5.6	22/5	2/8	19/9
90 lbs. super.	7.1	28/5	4/-	24/5

Carwarp.

No manure	—	—	—	—
30 lbs. super.	2.3	9/2	1/4	7/10
60 lbs. super.	4.9	19/7	2/8	16/11
90 lbs. super.	6.2	24/9	4/-	20/9

The tables show that the net profit per acre due to the use of 30 lbs. manure—the normal practice—ranges from 7s. 10d. to 9s. 5d. per acre after paying for the manure out of the value of the increased crop; and

when that application is doubled, *i.e.*, 60 lbs. per acre, that the net profit per acre is also doubled. It therefore amounts to 19s. 9d. at Cowangie and 16s. 11d. at Carwarp. If a further increase of 30 lbs. per acre is applied the net profit is raised to 24s. 5d. and 20s. 9d. at the two respective centres. In other words, it means that by an extra 60 lbs. of manure over the usual 30 lbs. a clear profit is given which ranges from 12s. 11d. to 15s. per acre after all charges for the extra manure have been met.

These returns are so striking that they cannot afford to be neglected by the average Mallee farmer.

What is specially interesting about the results this year is that the profits are considerably higher than is normally the case. Usually the profit is in the vicinity of 3s. or 4s. per acre. This proves conclusively that heavy dressings of superphosphate not only do *not* burn off the crop in a dry year, as many farmers suppose, but, on the other hand, they actually assist the crop to an even greater extent than in a normal year.

Heavy Dressings of Superphosphate Insures Crops against Drought at Carwarp. On the right, no manure; yield, 7 bushels. On the left, 90 lbs. super.; yield, 21 bushels.

When farmers in the newer Mallee learn to increase their quantity of superphosphate used to at least 60 lbs., and to fallow carefully, they will have in a large measure secured themselves against drought. Mr. P. G. Stewart, M.P., the experimenter at Carwarp, now sows 60 lbs. of superphosphate as standard practice over the whole of his farm. To this, and the systematic working of his fallows, the successful yield of his crops this year, in spite of the drought, is entirely due.

At Warracknabeal, on the Mallee fringe, the average results for the eight years 1912-1919 show that the net profit per acre after paying for the cost of the manure when ½ cwt. of superphosphate was used was 21s. 1d., when 1 cwt. is was 25s. per acre, and where 1½ cwt. was used it was 26s. 11d., wheat being valued at only 4s. per acre.

At Longerenong College, on the black land, a seven years' average shows that 1 cwt of superphosphate, costing 5s., gave an increase over the no-manure plot of 6.87 bushels per acre, which, at 4s. per acre, is

worth 27s. 10½d., a net profit of 22s. 10½d. When 2 cwt. was used an increase of 8.5 bushels resulted in a net profit of 24s. to the acre.

Similar figures have been obtained for Werribee and Rutherglen. Summed up, they mean that those farmers in all districts except the new Mallee who are not using 1 cwt. of superphosphate to the acre, are throwing away about a bushel of wheat to the acre which they might have for nothing. It is important to note that the higher the price of wheat, the greater becomes the value of the increased crop resulting from heavy dressings of superphosphate.

Increasing the Carrying Capacity.

In the Wheat Belt.

But perhaps the largest gain which results from the adequate use of superphosphate is to the pastures that follow the wheat. Careful tests made at the Werribee Research Farm have shown that the growth of grass and self-sown crop is in direct proportion to the amount of manure applied the year before. Therefore, double the manure and double the pasture that follows the wheat.

Similar results have been widely observed in the wheat districts.

In the Moister Country.—Rainfall Over 20 Inches Annually.

The response that soils of the wheat belt make to phosphatic manures might have been expected from a consideration of their analyses. The soils elsewhere are equally deficient in phosphates, and they likewise respond well to phosphatic manures.

Here the native grasses show a marked response to top-dressing. At Rutherglen, on a 21-in. rainfall, 1 cwt. of superphosphate top-dressed annually so improved the bulk and the quality of the herbage that the carrying capacity was doubled, and sheep placed on the paddock which had been top-dressed gained twice as much weight as those run on an equal sized unmanured portion. Last year at Hamilton 1 cwt. of superphosphate and 10 cwt. lime caused a remarkable increase in the growth of herbage, as compared with other plots given different treatment.

In these tests, the plots were not fed off to sheep, nor have they been conducted for a sufficiently lengthly period to warrant accurate deductions, being made; but the results, so far, indicate that lime will play a far more important part in these districts than it does in the wheat belt. The first cost of application of lime is somewhat high, but its effect may be expected to last for a number of years. But whatever may be the whole truth about the use of lime, there is no gainsaying the advantages that will accrue from the use of a top-dressing of superphosphate at the rate of 1 cwt. to the acre over wide areas of pasture in these districts.

Summing Up.

Increased production is vitally necessary on the part of all sections of the nation to help reduce the war debt and make up the arrears of work lost during the war. Every one has his special part to play, the farmer's task being to win more wealth from the land, particularly more wheat and more wool. He is not asked to do it for nothing, for everything points to the likelihood of there being substantial personal reward to those who will put forth the maximum effort during the next few years. Now is the time to act!

RESULTS OF FIELD TESTS IN THE WHEAT BELT.

A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent, and H. A. Mullett, B.Ag.Sc., Chief Field Officer.

I.—Insurance against Drought.

Fertilizers and Fallow in the Mallee.

The new Mallee areas settled during the past ten years, comprising about 250,000 acres of cultivated land, have been subject this year to severe drought conditions. During the wheat-growing period the total rainfall was only about 5½ inches, with the result that almost 75 per cent. of the crops have completely failed. Yet, in many cases, yields of between 12 and 18 bushels have been harvested, so that, while most of the crops failed utterly, others were not merely good, but very good indeed. What is the reason of this wide difference in results from farms alike in respect to soil, and subject to precisely similar climatic conditions? That is the question that the Agricultural Department has been investigating. And the solution is a very simple matter after all. The good yields obtained from 25 per cent. of the land have been due to the strict attention paid to fallowing of land and to the application of superphosphates. Where there was no fallowing or manurial dressings there was failure. Farmers who had had a measure of success had paid regard to the results of the experiments conducted on Mallee farms by the Department.

Experimental field plots were established by the Department in 1915, in order to determine the best types of wheat to grow and the most profitable quantities of fertilizers to use. A most convincing demonstration of the efficacy of good cultural methods in obtaining heavy crop yields, especially in dry years, had also been provided. The outstanding feature has been the advantages gained by using liberal dressings of superphosphate. The average amount of super. ordinarily used in these newer Mallee areas is about 30 lbs. per acre. The experiments conclusively demonstrated that the dressings of 60 to 90 lbs. give a considerably higher net profit than lighter dressings.

The results of the tests at Carwarp and Cowangie have been tabulated. The plots at Carwarp were conducted by Mr. P. G. Stewart, M.H.R., and those at Cowangie by Mr. H. F. Hecht. The season during 1919 proved extremely dry, the rainfall from 1st May to 30th November being less than 5½ inches at both Cowangie and Carwarp, or an average of only 90 points per month during the growing period of the crop. The plots were sown towards the end of May with 45 lbs. of graded Federation seed, with varying quantities of superphosphate per acre, with the following results:—

Treatment.	Cowangie.	Carwarp.
	bushels.	bushels.
No manure	9·5	6·3
30 lbs. superphosphate	12·2	8·6
60 „ „	15·5	11·2
90 „ „	16·6	12·5

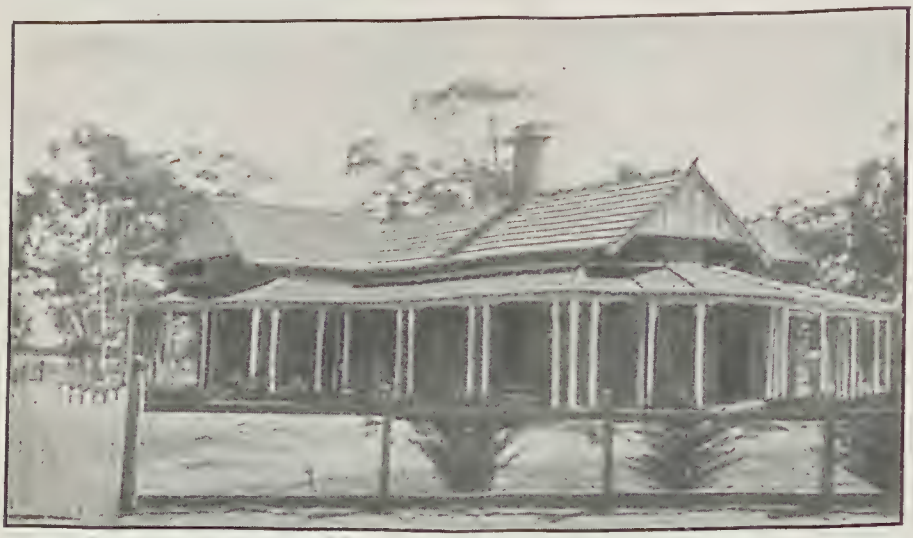
These yields, it is claimed, are a striking testimony of the fertility of the Mallee country, even in a dry year, when properly fallowed and manured. The cash benefits from these results can be seen from the balance-sheet published below. The wheat has been valued at the low rate of 4s. per bushel, and the manure at £5 per ton. The figures are on a one-acre basis:—

COWANGIE.

—	Increase.	Value at 4s. per bushel.	Cost of Manure.	Net profit per acre.
	bushels.	s. d.	s. d.	s. d.
No manure	2·7	10 9	1 4	9 5
30 lbs. superphosphate	5·6	22 5	2 6	19 9
60 „ „	7·1	28 5	4 0	24 5
90 „ „				

CARWARP.

No manure	2·3	9 2	1 4	7 10
30 lbs. superphosate	4·0	10 7	2 8	16 11
60 „ „	6·2	24 9	4 0	20 9
90 „ „				



A Farm Home in the Wimmera. This fine home was built from the profits of wheat growing.

These tables show that the net profit per acre, due to the use of 30 lbs. of manure — the normal practice — ranges from 7s. 10d. to 9s. 5d. per acre, after paying for the manure out of the increased value of the crop; when the application is doubled the net profit per acre is also doubled. It, therefore, amounts to 19s. 9d. at Cowangie, and 18s. 11d. at Carwarp. If a further increase of 30 lbs. per acre is applied, the net profit is raised to 24s. 5d. and 20s. 9d. at the respective centres. This means that by an extra 60 lbs. of manure over the usual

20 lbs., a clear profit is given which ranges from 12s. 11d. to 15s. per acre, after all charges for the extra manure have been met.

These returns are so striking that the average farmer cannot afford to ignore them. What is specially interesting about the results this year is that the profits are considerably higher than is normally the case. Usually the profit is in the vicinity of 3s. or 4s. per acre. This proves conclusively, however, that heavy dressings of super. not only do not burn off the crop in a dry year, as many farmers suppose, but, on the other hand, actually assists the crop to an even greater extent than in a normal year. When farmers in the newer Mallee learn to increase

A Farm Home in the North. Wheat paid for the residence, the improvements, and the motor-car.

their quantity of superphosphate used to at least 60 lbs., and to fallow carefully, they will have, in a large measure, secured themselves against drought. Mr. P. G. Stewart, M.H.R., the experimenter at Carwarp, now sows 60 lbs. of super. as standard practice over the whole of his farm. To this, and the systematic working of his fallows, the successful yield of his crops this year in spite of the drought, is entirely due.

Bare Fallow and Superphosphate Insure Crops Against Drought.

Fallow and Fertilize.

II.—Heavy Dressings of Superphosphate Prove Profitable on the Mallee Fringe.

Part of the propaganda work carried out by the Department of Agriculture, with a view to increasing the application of scientific methods to the raising of crops, embraces experiments on private farms in various parts of the State. Besides being popular amongst the individuals concerned, these experiments have proved of great value to the general farming community in the locality. Up to the present the experiments have not been extended beyond manurial tests, and the determination of the most valuable varieties of wheat that may be grown in the localities. Farmers prepare the fallow land in the usual way, and, under supervision, sow the wheat to be used for experimental purposes in half-acre plots. At harvest-time the crop is taken off and weighed.

The results of manurial tests, carried out during the past eight years on the farm of Mr. G. Coutts, Warracknabeal, an important centre in the Wimmera wheat belt, convey some interesting lessons. The results are regarded as valuable confirmation of the experiments conducted at the State farms and at Longerenong College. More important still, they demonstrate to farmers in the Wimmera district the profit to be derived from what are now well-defined practices. Manurial plots were sown on 3rd June with 60 lbs. of graded Federation wheat. The quantities of manures used on the various plots are shown in the table. Last season was exceptionally dry, only 4 inches and 60 points being registered from 1st June to the end of October. In the following table are shown the results for last season, and the average for eight years:—

	1919. Bushels per acre.	Average, 1912–1919. Bushels per acre.
1. No manure	11·7	13·4
2. ½ cwt. superphosphates	13·4	19·3
3. 1 cwt. super.	15·7	20·9
4. 1½ cwt. super.	16·8	22·0
5. ½ cwt. super. and ½ cwt. basic slag	16·4	20·9
6. 1 cwt. basic slag	17·5	19·5
7. 1 cwt. super. and 10 cwt. lime (1913)	18·3	21·1
8. 1 cwt. super. and 40 lbs. nitrate of soda	16·2	20·1
9. 1 cwt. super., 40 lbs. nitrate of soda, and 40 lbs. sulphate of potash	16·0	20·1

The dry season just experienced has afforded the opportunity for a critical test of those dressings of manure which have proved most profitable since the inception of the plots, namely, applications of superphosphate up to 1½ cwt. to the acre. It was commonly supposed that in a dry year the crop would wither, or "burn off," but the results, as in 1914, showed that such was not the case. Farmers can, therefore, apply heavy quantities of super. in a dry year without the slightest fear that harm from "burning off" will result. As superphosphate

costs money, it is of vital interest to know just how payable it is to manure the crop in accordance with the results of the tests. In the following balance-sheet, prepared from the average results of eight years, the increased yield of wheat, and its value, are set out, and the cost of the manure responsible for the increase is deducted. The difference, therefore, represents the net profit which directly results from the use of the manure. The figures are on the basis of yields per acre:—

—	Increase due to Manure.	Value of Wheat at 4s.	Cost of Manure.	Net profit per acre.
	bushels.	s. d.	s. d.	s. d.
No manure	..	..	..	..
1 cwt. basic slag	6·1	24 5	5 0	19 5
½ cwt. super.	5·9	23 7	2 6	21 1
1 cwt. super.	7·5	30 0	5 0	25 0
1½ cwt. super.	8·6	34 5	7 6	26 11

The table shows that of the phosphatic manures, the water soluble type, or superphosphate, is best, and that steadily increased yields, as well as net profit per acre, are obtained from dressings of superphosphate up to, and including, 1½ cwt.

The normal practice in the Wimmera district is to sow 56 lbs. of super. The net profit in this case is 19s. 5d. per acre. The tests, however, prove that an additional 56 lbs. will return a further profit of 3s. 10d. per acre, after paying for the manure, and if the dressing be still further increased by another 56 lbs., then an extra profit of 1s. 11d. per acre will accrue, or, roughly, 5s. per acre in all over what is normally obtained.

There is another feature of the extra returns which result from liberal manuring with phosphates. Its influence extends to the sheep department of the wheat farm, which provides a substantial proportion of the total profits. It is found that the grass and sheep feed which grows in the stubbles of a heavily manured crop is, at least, doubled as compared with that following a crop manured in the ordinary way. Mr. Coutts and a number of other farmers throughout the wheat belt are so impressed with these returns that dressings of 1 cwt. of super. to the acre have been adopted as a standard practice over the whole of their farms.

Heavy Dressings of Super. Feed the Crop and Feed the Grass.

Use Superphosate Liberally on the Peace Crop.

III.—Heavy Dressings of Superphosphate Prove Profitable in the Wimmera.

The results obtained last year, and the average results for the past seven years, from a series of manurial plots conducted by the Department of Agriculture at Longerenong College, are shown hereunder. The plots were sown on fallowed land, on 13th June, with graded Federation seed at the rate of 75 lbs. per acre. The cultivation of each plot was identical, but different manurial dressings were applied on each plot. Hence the differences in the yields per acre may be ascribed to the influence of the various fertilizers.

Yield per Acre.

Treatment.	Average Yield Per Acre—	
	1919.	For 7 years.
	Bushels.	Bushels.
No Manure..	25·74	25·0
Superphosphate ½ cwt. per acre	31·26	31·35
Super. 1 cwt.	31·61	31·97
Super. 2 cwt.	33·25	33·49
Super. 1 cwt. + Lime 5 cwt...	30·56	28·95
Super. 1 cwt. + Lime 10 cwt...	31·61	29·33
Super. 1 cwt. + Nitrate Soda 40lbs., with seed.. ..	31·65	28·70
Thomas' Phosphate 1 cwt.	25·31	25·94
Super. 1 cwt. + Nitrate Soda 40 lbs., Sulp. Potash 40 lbs.	31·36	30·76
Super. ½ cwt. + Thomas' Phos. ½ cwt...	30·45	29·65
Super. 1 cwt. + Nitrate Soda 40 lbs. (Spring)	29·40	30·4
Farmyard Manure 10 tons.	26·95	30·08

The rainfall during the growing period of last season was only 4.39 inches, the heaviest fall in any one day being .44 inches, yet the average yields of the plots ranged from 25 to 33 bushels per acre. The returns show that wheat yields in the Wimmera may be maintained at a high level by bare fallowing, judicious cultivation, and the liberal use of phosphates.

From the unmanured plot the average return for the past seven years, including the drought season of 1914, was exactly 25.0 bushels per acre. In other words, the land was sufficiently fertile to yield, by good cultivation and bare fallowing, 25 bushels per acre. This seven-year average yield is considerably above that of the county, and is double the average yield of the State for the same period. By the aid of phosphatic fertilizers, however, the average yield for the seven-year period was lifted from 25 bushels to from 30 to 33 bushels per acre.

Thus the application of 1 cwt. of superphosphate, costing 5s. per acre, gave an increase of 6.97 bushels per acre, which, at the low value of 4s. per bushel, is worth 27s. 10½d., showing a net profit of 22s. 10½d. per acre over the unmanured plot. The application of 2 cwt. of super.

further stimulated the yields, resulting in an increase of 8.5 bushels per acre, worth 34s. per acre, showing a net profit of 24s. per acre as compared with the unmanured area.

It is significant that no other phosphatic fertilizer, used either by itself, or with a mixture of superphosphate, gave such good returns as superphosphate alone. Nor did the application of nitrogenous or potassic manures appreciably affect the yield.

It would appear, therefore, that, despite the length of time the Wimmera lands have been under cultivation, there is no necessity yet to turn to nitrogenous or potassic fertilizers as a means of increasing production. On the other hand, the call for water soluble phosphates

Preparing the Land.

such as super. is becoming more insistent each year, especially for heavier dressings of fertilizer. The heavier applications not only show a greater profit per acre, but they assist in stimulating the grass that follows the wheat crop, and so help to increase the stock-carrying capacity of the farm. The bulk areas sown to wheat on the Longerenong College Farm have been uniformly dressed with 1 cwt. super. for the past four years, with the result that the average yield of the farm has been steadily increasing.

The Liberal Use of Superphosphate will Lift Wheat Yields in the Wimmera.

IV.—Increasing the Carrying Capacity of Pastures.

The sheep industry in Australia is, in the nature of things, almost dependent on the condition of the native pastures. In Victoria alone half the area of the State, or 28,000,000 acres, is under natural grass, although additional grazing is furnished by about 1,000,000 acres of sown grasses, the stubbles of 4,000,000 acres of cultivated crops, and a small proportion of forage crops.

When the seasons are good, grass is abundant, and the live stock industry is prosperous. When the rainfall is deficient, grass is scanty, and the industry declines. It is reliably estimated that there are now being maintained in this State some 15,773,000 sheep, whereas the normal figure for years past has averaged, roughly, 12,000,000 or 13,000,000.

Table Showing Total Number of Sheep in Victoria, and Number Available for Export in 1919.

District.	Total Number of Sheep, March, 1919.	Approximate Number Available for Export.
Mallee	841,155	170,000
Wimmera	2,442,365	490,000
Western	4,854,243	970,000
Northern	2,504,177	500,000
North Central	1,374,255	275,000
Central	1,391,355	280,000
North-Eastern	1,039,886	200,000
Gippsland	1,326,466	265,000
Total	15,773,902	3,150,000
Estimated Number required for Local Consumption	..	2,500,000
Estimated Annual Surplus	..	5,650,000

What is occupying the attention of those responsible for the welfare of the live stock industry at the present time is how to continue to carry in safety the surplus 2,000,000 sheep.

In a statement issued by the Department of Agriculture it is stated that if the frozen meat and wool industry is to go forward without a setback, it will be imperative to make considerably greater provision for extra feed for live stock. All available areas should be sown in March with autumn forage crops, such as rape, oats, and barley. But this is not the only method of increasing sheep feed, as commonly supposed, for both at the State and private farms experiments have shown that it is possible to materially increase pastures by the use of fertilizers. Natural grass can be manured directly by top-dressing, and stubble pastures can be fertilized through the wheat crop.

These experiments show that the direct application of manure to natural grass is especially applicable to districts where the rainfall is over 20 inches annually, while stubble pastures can be increased right throughout the length and breadth of the wheat belt. It has been

VICTORIA
MALLEE
Nº OF SHEEP 1919 841 155
170 000 AVAILABLE FOR EXPORT
WIMMERA
Nº OF SHEEP 1919 2 442 365.
490 000 AVAILABLE FOR EXPORT
NORTHERN
Nº OF SHEEP 1919 2 504 157
500 000 AVAILABLE FOR EXPORT
NORTH CENTRAL
Nº OF SHEEP 1919 1 374 255
275 000 AVAILABLE FOR EXPORT
Nth EASTERN
Nº OF SHEEP 1919 1 039 886
200 000 AVAILABLE FOR EXPORT
CENTRAL
Nº OF SHEEP 1919 1 391 355
280 000 AVAILABLE FOR EXPORT
WESTERN
Nº OF SHEEP 1919 4 854 243
970 000 AVAILABLE FOR EXPORT
GIPPSLAND
Nº OF SHEEP 1919 1 326 466
265 000 AVAILABLE FOR EXPORT
Map of Victoria showing Number of Sheep in 1919
and Approximate Number Available for Export

proved by careful experiment that the quantity of grass following the wheat crop manured with 1 cwt. of superphosphate is not only, at least, doubled, but is, moreover, of better quality. There is, for instance, usually a much greater proportion of the burr clover, or trefoil, a native legume of high feeding value. The extra cost of the manure is more than repaid by the extra yields of wheat, so that the enhanced feeding value of the stubbles is all profit.

The method of applying manure directly to the pastures is available, however, over a much wider field, with the proviso, of course, that the rainfall must be over 20 inches annually.

Tests made at the Experiment Farm, Rutherglen, on large plots of virgin grass, which were manured, and then fed off to sheep, show that the carrying capacity may be doubled by the application of 5s. worth of superphosphate.

Fallowing in the Wimmera. Sheep materially help in cleaning and consolidating the fallows.

The figures were arrived at by actually weighing the sheep on and off the plots, and comparing the gain in weight with that which resulted when similar sheep were grazed on an equal area of grass that was unmanured.

The results of preliminary tests made at Hamilton last year show that even greater increases are possible in similar districts, and points to lime, in addition to superphosphate, as being necessary on these soils.

It is estimated that if the practice of manuring pastures were widely adopted, especially in the southern districts of the State, the extra feed would support large increases in the numbers of sheep carried.

Top Dress Your Grass Land with Phosphates.

V.—Crop Rotations for Wheat.

Different crops vary widely in the manner in which and the depth at which they obtain their nutriment from the soil. Some obtain their food from relatively shallow depths, others are deep rooted, and by alternating such crops the fertility is more evenly used up.

It often happens that the residues of crops show a toxic effect towards roots of the same variety, but a beneficial effect on roots of another species. This is one of the chief reasons accounting for the beneficial effect of rotations.

The relation of one crop to another in this respect has not been fully investigated. It is well known, however, that crops like red clover will not thrive when sown oftener than once in four years. The land gets "clover sick." Flax is another crop which cannot be grown profitably if sown on the same land too often.

There are also economic advantages in rotating crops. A good system of rotation enables the labour of the farm to be more evenly distributed throughout the year. Different crops require sowing and harvesting at different seasons, and on the one-crop-farm there is a rush at seed time and harvest, whilst the rest of the year is slack.

Finally, rotation checks the devastation of insects and fungi by changing the locality of the crops which they affect, and by changing the conditions under which they are grown. If crops of the same kind are grown continuously, insect and fungoid pests increase from year to year.

In the wheat districts of Victoria systematic crop rotation is more difficult of application than in other more favoured parts of the State, owing to the limited range of the crops which can be grown in the wheat belt. The choice of crops to rotate with wheat is restricted in these areas to barley, oats, and an occasional forage crop such as rape or peas.

At Longerenong, Rutherglen, and Werribee, experiments have been conducted to test the value of various systems of rotation for wheat. The results of the Longerenong tests for 1919 are as follow:—

Rotation used.	Crop. bushels.
1. Wheat, pasture, barefallow	27.50
2. Wheat, oats, pasture, barefallow	27.42
3. Wheat, oats, barefallow	23.46
4. Wheat, rape, barley, peas	22.92
5. Wheat after barefallow	19.70
6. Wheat, oats, peas	17.96
7. Wheat, barley, peas	12.32
8. Wheat after wheat (continuously)	0.5

The season was extremely dry, the total rainfall during the growing period of the wheat crop being 4.4 inches.

It is of course too early to generalize on results of rotation tests which have been conducted for such a short period, but the results for 1919 are of interest because they show the influence in an extremely dry season on various crop yields.

So far as they go, these results show—

(1) Wheat grown continuously year after year is disastrous in a dry year in the Wimmera. The main cause of the low yield is the difficulty

of keeping land continuously cropped with the same type of crop free from weeds and fungoid diseases.

Wild oats are particularly troublesome in the Wimmera, and the low yield of the wheat after wheat plot was largely due to the prevalence of wild oats, which flourished to the exclusion of the wheat.

(2) Another feature of the results is the comparatively high yields secured after each rotation in which wheat is preceded by a well-worked fallow.

The rotations which gave the highest wheat yield were—(1) wheat, pasture, barefallow; (2) wheat, oats, pasture, barefallow. Both these averaged approximately 27½ bushels during the past year.

Increasing the Wheat Area.

(3) On the other hand, the two rotations in which the land was continuously cropped with cereals and forages, namely, wheat, oats, peas, and wheat, barley, peas, gave 17.96 and 12,32 bushels respectively.

Water was the limiting factor for crop production last year, and those rotations which included a preparatory barefallow for wheat show up to great advantage.

The results confirm the view that a rational crop rotation in which wheat after barefallow, alternated with a cereal such as oats or barley, or pasture, is essential for maintaining profitable crop yields in the Wimmera, and for extracting the greatest monetary return from the land.

Grow Wheat in Rotation with Fallow,

Cereals, and Pasture.

INCREASED WHEAT PRODUCTION.

E. A. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

In 1915 the Department of Agriculture appealed to the wheat-growers of Victoria to grow a record crop of wheat to help provide a surplus of food for the allied nations. To-day an appeal is being made to grow a record peace crop to help to liquidate the war debt and to bring profit to the growers.

The 1915 appeal was made to the patriotism of the growers. To-day the appeal is being made for more wheat because there is every reason to believe that prices will be high, and that big profits are assured. If Victoria produces a large exportable surplus of wheat during 1920, it will undoubtedly realize high prices on the world's markets, and be a source of considerable profit to the grower. It may well bring more money to the State than any previous crop in our history, and will, therefore, materially assist the State in meeting the heavy financial obligations caused by the war.

While the markets of the world are subject to wide fluctuations in price as the international supply and demand varies, there is every reason to believe that the world's wheat price will be high for the next two or three years. Let me enumerate the reasons for this belief.

In the first place, Europe in normal times produces half the world's wheat supply, and consumes the surplus of the rest of the world. Her normal production is 2,000,000,000 bushels of wheat. Can any one expect that European production will be restored to normal for at least a couple of years? Every European nation at the present moment is clamouring for breadstuffs, and though European Governments have guaranteed their farmers extremely high prices for wheat, production has fallen far short of requirements.

France, which normally raises 320,000,000 bushels, produced but 168,000,000 bushels in 1919. Italy, with a guarantee of £1 per bushel, produced but 160,000,000 bushels, as against a normal output of 220,000,000 bushels.

The greatest wheat field of the world—the great black plains of Southern Russia—yields in normal times about one-fifth of the world's wheat supply—some 800,000,000 bushels.

What has happened in that fertile region during the past two years has been shrouded in mystery, but there can be little doubt that the social and industrial unrest caused by the civil war and the revolution has caused production to fall far short of pre-war standards.

The prospects of crop production in the enemy countries cannot possibly be as favorable as that of the allied nations, for it was largely owing to shortage of foodstuffs that the enemy countries collapsed.

It is difficult to see how some of the wheat-growing countries of Europe, *e.g.*, Roumania, can obtain a normal output of wheat for many years. Roumania was stripped and despoiled of much of her agricultural machinery, stock, and implements by two years of enemy occupation. According to official statistics, she lost 80 per cent. of her live stock, including working horses and cattle, during the war. Under these

circumstances, it would be an amazing feat if such a country could recover its normal production within at least three years.

Despite all the encouragement given by Governments in the form of high prices and guarantees, the production of wheat has fallen lamentably short of requirements in Europe, and it seems hopeless to expect that her production will be restored to normal for several years at least.

On the other hand, production in the wheat-exporting countries shows no evidence of rapid expansion. True, the American crop of 1919 was the largest on record. It fell short of pre-harvest expectations, however, by at least 200,000,000 bushels, and recent cables show that the area of winter wheat for 1919-20 has declined by 10,000,000 acres as compared with last year.

Canada and Argentina have not materially increased their acreages, and though India will probably have a surplus during the coming harvest, it will all be required for Eastern consumption, to make up for the shortage in the rice crop. In Australia, the area under wheat has declined from 12,500,000 acres in 1915 to less than 8,000,000 for 1919.

The present position of the world's wheat supply is such as to cause importing nations the greatest concern, and should the coming harvest in the northern hemisphere not prove bountiful, it is certain that high prices for wheat will prevail for the next twelve months at least.

European Governments have maintained stabilized prices for wheat during the war period only by means of heavy annual subsidies. It has been stated in the past that the British Government has maintained the price of a loaf of bread at 9d. at an annual cost to the Treasury of £60,000,000.

The price of imported wheat in Britain was recently raised to 12s. per bushel, but to sell imported wheat even at this price will cost the British Government millions per annum.

The present price of wheat in Europe, based upon f.o.b. value for wheat and an open market for freight, is somewhere in the neighbourhood of 16s. per bushel at the present time.

Apart from the present world supply and demand, and the high prices that are ruling for wheat wherever there is an open market, the teaching of history shows that after every big war prices of wheat rise to high levels during the period of reconstruction.

In 1914 I prepared a chart (which is reproduced on the folding sheet opposite page 202) to show the influence of war on wheat prices. A study of wheat prices for the past 150 years proves definitely that they rise rapidly during a war, and remain at a high level for two or three years after the declaration of peace.

I believe that history will again repeat itself, and that it would be futile to expect cheap wheat for at least several years after the most disastrous war of all time.

Finally, the price of wheat for the coming crop has been guaranteed by the Commonwealth Government at 5s. per bushel nett on the local railway station. This is a guarantee—a minimum guarantee—a guarantee against risk. The farmer is assured, therefore, of a minimum of 5s. per bushel; but, of course, he will get the world's parity for the surplus, whatever that parity may be. From the evidence already submitted there is every reason to believe that the parity will be high.

There is every incentive, therefore, for the farmer to bend all his energies towards increased production during the next few months. There are two ways in which farmers may increase production—(1) increasing the acreage under crop, (2) improving the methods of production and growing more bushels per acre.

Those who own large areas of land, and are favorably situated with respect to team strength, implements, and labour, can best help by increasing the acreage under crop. Those who have small holdings can increase production by growing the crop under the most favorable cultural conditions.

Increasing the Acreage under Crop.

During the past few years many large wheat-growers have greatly reduced the area under wheat, and have increased the number of sheep. The difficulty of securing efficient farm labour, coupled with the more favorable prices for wool and mutton, are largely responsible for this decrease in area.

In view of all the circumstances it was, perhaps, sound policy for these large land-owners to increase their grazing interests at the expense of the wheat crop. But with the prospective high prices for wheat, cultivation again becomes relatively far more profitable than grazing for the large land-holders.

At the present time there are 1,700,000 acres under bare fallow. Normally, a small proportion of this is sown with oats or hay. It is to be hoped that the whole of the fallow in the wheat districts this year may be reserved for wheat, and that hay and oats will be sown on stubble or autumn-ploughed land.

In the Mallee and Northern Districts a considerable proportion of last year's sowing was a failure, and bore only stunted crops. A large proportion of this could be worked up at comparatively small expense and sown with wheat. The land bearing this stunted crop is to all intents and purposes equivalent to a fallow, and with a relatively small amount of work could be got ready for seeding a crop. Probably nearly a million acres of such crop could be got ready for seeding.

Every year some 900,000 acres of crop are sown on autumn-ploughed hay or stubble land, and such an area may be expected this year. Then from virgin land and induced extra sowings on the part of farmer graziers an area of 400,000 acres might be expected. This would give a peace crop of 4,000,000 acres. With favorable autumn rains this acreage is possible, and its yield would be a fine asset should the season prove but normal.

Increasing the Efficiency.

There is another and even better way of raising a big crop—increasing the yield per acre by using the best and most approved farming methods. Nearly every district has its thorough farmers and its slovenly farmers. Frequently a barb wire fence separates one group from the other. The grower of a 30-bushel crop often lives alongside the grower of a 10-bushel crop. It is not the quality of the land which accounts for the difference in yield, but the quality of the man and the quality of the farming. Thorough working of the soil, liberal use

of fertilizers, systematic crop rotation, rational treatment of seed are the corner-stones on which successful wheat culture is based.

I do not propose to deal with these exhaustively, but merely direct attention to one or two points of practical importance. Successful wheat culture north of the Dividing Range is based on bare fallow—the longer and more thorough the fallow the better for the crop. Conservation of moisture is the objective. Carefully conducted experiments at Rutherglen have shown that every inch of rain over one acre is capable of producing an extra bag of wheat. Analyses of the moisture contents of bare fallow and stubble ploughed land at Longerenong have shown that under a careful system of fallowing, even in a dry year, an equivalent of at least 4 inches of rain can be carried over from one season to another. This extra moisture is capable of giving an additional yield of 12 bushels per acre.

Top-dressing of pastures with phosphates raises the stock-carrying capacity of the land in districts of liberal rainfall. In the dry districts increase the stock-carrying capacity of the pastures by applying liberal dressings of phosphates to the wheat crop.

Careful fallowing and thorough working of the soil are essential for successful wheat culture north of the Divide.

In the Wimmera this principle is appreciated, and has become engrafted on the practice of the district, for something like 90 per cent. of the wheat crop in Borung county is sown on fallowed land.

In the moister districts—Gippsland and the Western District—conservation of soil moisture is of secondary importance, because the rainfall during winter is usually sufficient to produce an abundant crop. Hence, fallowing as a preparation for wheat can to a great extent be eliminated, and in its place the raising of forage crops for feeding to stock substituted. On the other hand, in the Mallee areas, where the rainfall is lighter than in any other part of Victoria, conservation of soil moisture and bare fallowing are of paramount importance. Yet

it is in this great wheat province that bare fallowing is least practised. The Mallee will never come into its own as a wheat province until the thorough methods of the Wimmera are universally practised.

Last season was a critical test for the Mallee areas, and there were numerous total crop failures. But there were many notable instances where fallow and fertilizers won a victory over drought in this dry north-western area. Some of these cases are recorded elsewhere in this issue.

The liberal use of fertilizers affords a sure means of increasing production. Year after year the experimental plots conducted by the Department on private farms and the experimental stations have demonstrated the value of liberal dressings of phosphates compared with light dressings. In the Mallee, the Mallee fringe, the Wimmera, the Western Plains, and in the North-East there is clear evidence that the farmer may increase his allowance of fertilizers with every assurance of increased profit. A dressing of at least 60 lbs. of superphosphate in the Mallee, 90 lbs. in the Mallee fringe, and 120 lbs. in the Wimmera may be applied with every confidence on well prepared fallows. The heavier dressing gives a bigger net return of wheat, and, in addition, increases the stock-carrying capacity of the land. A careful study of the results of the manurial tests for last season in the Mallee, the Mallee fringe, and in the Wimmera gives confirmation of this. The results which are given in this issue are the more striking, because 1919 was an exceptionally dry year. Liberal dressings of superphosphate have everywhere demonstrated their superiority, not only in wet years, but also in very dry seasons.

Liberal fertilization and thorough working of the seed-bed prior to sowing are especially desirable this season. The summer and autumn rains have been very light in the wheat belt, and as a result the fallows and stubble ploughed land will be more open than usual. Experience has demonstrated the necessity for a fine, firm consolidated seed-bed for wheat, and good cultivation during seeding will assist in effecting that consolidation of the soil which is usually brought about by the packing action of the autumn rains.

Summary.

High prices for wheat seem assured for at least several years. The grower has been guaranteed by the Government 5s. net on local railway station for all wheat he can raise during 1920. The grower is urged to take full advantage of the opportunity presented either by increasing the acreage sown to wheat, and by using the best farming methods in putting in the coming crop, or by both.

As the prospects for good prices seem assured for several years it would appear advisable to fallow as large an area as possible for next year immediately after the present seeding is over. What each grower can do towards increasing his acreage will depend on the circumstances in which he is placed, and the extent to which good rains fall during this and next month.

But all growers are urged to use the approved farming methods for sowing the coming crop. These methods are summarized in the following four pages, under the heading "Factors for Successful Wheat Culture."

No. 1

Thorough Cultivation

Careful Fallowing conserves Soil Moisture.

Every Inch of Rain conserved the soil adds an extra bag to the crop.

Tests in the Wimmera show that 4 inches of Rain may be conserved by early fallowing and careful working.

FALLOW THE LAND EARLY

A Neglected Fallow is little better than No Fallow.

Average Results of Four Years' Cultivation Tests at Rutherglen Experiment Farm.

Treatment.	Average yield in bushels per acre.
1. Ploughed 5" in July and worked through the Summer	17·5
2. Ploughed 5" in July and not worked through Summer	12·8
3. Ploughed 5" in Autumn just before Seeding	7·4

WORK THE FALLOWS WELL

— No. 2 —

Liberal Manuring

The Result of Five Years' Tests show that of all Manures tried ***Superphosphate*** in Heavy Dressing is the Most Profitable.

5 YEARS RESULTS AT LONGERENONG

PLOT.	Average Yield per Acre.	Average Increase due to Manure per Acre.	Net Profit per Acre. Valuing the Increase at 4/- per bushel, and deducting cost of Manure.
	Bushels.	Bushels.	
No Manure	24·3	—	—
Basic Slag, 1 cwt. ...	26·4	2·1	3/4
Super. ½ ,, ...	30·4	6·1	21/10½
Super. 1 ,, ...	31·4	7·1	23/4½
Super. 2 ,, ...	33·1	8·8	25/2

Liberal Manuring Feeds both the Wheat and the Grass that follows the Wheat

FACTORS FOR SUCCESSFUL WHEAT CULTURE

No. 3

Rational Use of Seed

1. Choose Varieties Suited to Your District

Make a choice from the following varieties :—

Early Maturing Types	Mac's White Gluyas, Bunyip, King's Early, Steinwedel.
Midseason Types	Federation, Penny, Dart's Imperial.
Late Maturing Types	Currawa, Major, Marshall's, Yandilla King.

Sow Late Maturing Types First, and Early Maturing Types Last.

Increase Dressing of Seed and Fertilizer towards close of Seeding Season.

2. Grade the Seed

Results of Graded Seed Tests Wyuna State Farm :—

PLOT.	Yield per Acre.
Normal Seed (direct from Harvester) ..	25 bush., 27 lbs.
Grade No. 1	28 bush., 6 lbs.
Grade No. 2	27 bush., 53 lbs.
Grade No. 3	23 bush., 50 lbs.

Grade the Seed and Feed No. 3 Grade and Screenings to the Stock.

3. Select the Seed

Average Results of 5 years Seed Selection at Longerenong :—

Selected Federation .. 36·1 bushels per acre.
Ordinary " .. 30·3 " "

4. Pickle the Seed

Keep Smut from the Farm by Pickling with Bluestone (1½ lbs. to 10 gallons water); or Formalin (1 lb. to 50 gallons water).

Immerse Seed in Pickle from 3 to 5 minutes.

FACTORS FOR SUCCESSFUL WHEAT CULTURE

No. 4

Regular Rotation of Crops

Advantages of Crop Rotation in the Wheat Belt.

(1). "Take-all," Flag-smut, and other diseases avoided.
(2). Farm work distributed evenly through the year.
(3). More sheep can be kept.
(4). Soil fertility easily maintained.
(5). Heavy wheat assured.
(6). Most profitable in every way.

Grow Wheat in Rotation with Fallow, Cereals, and Pasture

Systems of Crop Rotation Recommended.

1. For the Mallee—

(1) Wheat. (2) Pasture. (3) Bare Fallow.

2. For the Wimmera—

(1) Wheat. (2) Oats. (3) Pasture. (4) Bare Fallow.
or (2) Wheat. (2) Oats for Sheep. (3) Bare Fallow.

3. In drier districts sow Catch Crops for early Autumn feed.

In moister districts include Forage Crops, *e.g.*, Rape, Peas, or Oats, regularly in the Rotation.

KEEP SHEEP ON EVERY WHEAT FARM

FLAG SMUT.

(*Urocystis tritici*, Koern.)

By C. C. Brittlebank, Plant Pathologist.

Numerous inquiries have recently been received from wheat-growers as to the cause and control of Flag Smut in wheat, a disease which has increased to an alarming extent in some wheat-growing areas. Mr. McAlpine's work, *The Smuts of Australia*, published by the Department of Agriculture, Victoria, 1910, contains all that is known on the subject, and this book should be in the hands of every grower, as it not only deals with Flag Smut, but with all the known Smuts affecting cereals.

Flag Smut is one of those insidious diseases which cause loss right through the growing season, and often, where its presence is unsuspected, weather and other conditions are held responsible for the damage. On the other hand, Rust, under favourable weather conditions, spreads rapidly and ruins the crop within a few days, and the impression made by its sudden appearance and the damage done leads many to regard it as the most serious disease by which our wheat crop is attacked. Considering, however, that Rust epidemics are few and far between, while Flag Smut is annually taking toll of from 5 per cent. to nearly 70 per cent., the total loss caused by Rust sinks into insignificance when compared with that resulting from Flag Smut.

Organism causing the Disease.

The organism responsible for the injury to the wheat plants is one of the microscopic fungi, commonly known as Smuts from the appearance of their sooty spore mass. As this fungus chiefly affects the flag, the common name Flag Smut has been accepted; scientifically, it is known as *Urocystis tritici*, Koern.

This fungus was first noticed in Australian wheat, its first appearance having been reported from South Australia in 1868, and at a later date it was observed in Indian and Japanese wheat crops. It was only recently, however, that it appeared in growing wheat in the United States of America, and most probably it was carried into that country in shipments of wheat from Australia.

Many fungus diseases are introduced by means of seed of various kinds, and, therefore, the strictest examination should be made of all seed imported from a country where any destructive fungus disease is known to exist.

Appearance of Diseased Plants.

Wheat plants show the outward visible effects of attack from the time they are seedlings to a stage not far removed from maturity. Generally, long dark leaden-coloured streaks, caused by the black spores under the epidermis of the flag, appear on the flag and sheath. At a later stage, the flag twists, curls, and withers (Fig. 1), and, becoming

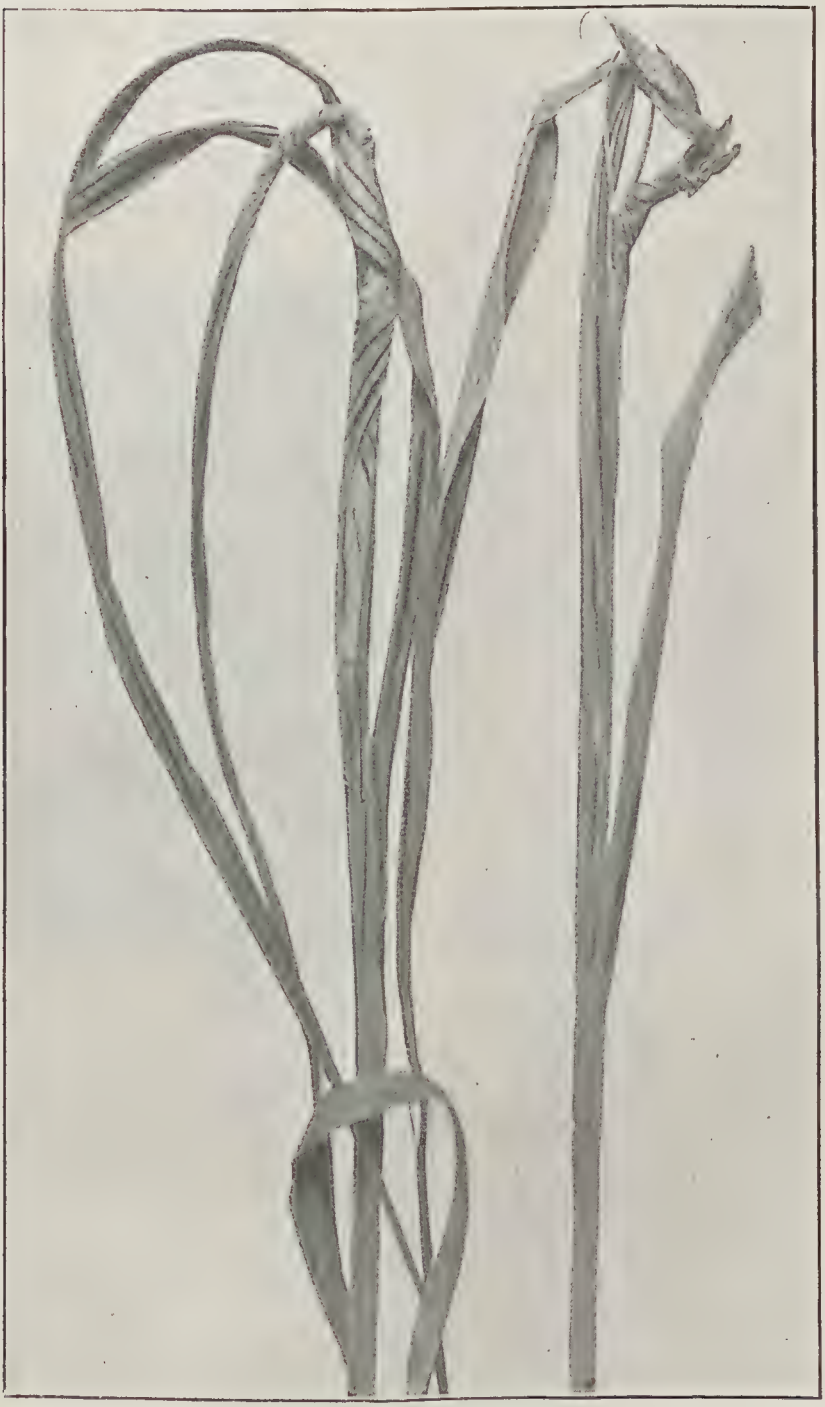


Fig. 1.—Flag Smut of Wheat.

[From *The Smuts of Australia*, by D. McAlpine.]

broken, liberates the mass of spores which, together with fragments of flag, are mixed with the surface soil and form a centre of infection for the following crop.

As a rule, affected plants do not reach maturity, but one or two straws on a stool may occasionally produce a few shrivelled grains. Plants in which the disease develops while they are still young die out. Often, however, the disease is not pronounced until the crop is half grown, and then it happens that a crop which promised well in the early stages of growth becomes a partial failure. (Figs. 2 and 3.)

Fig. 2.—Clean and Flagsmutted Wheat.

A. Twenty-one healthy plants.

B. Twenty-one diseased plants.

[From *The Smuts of Australia*, by D. McAlpine.]

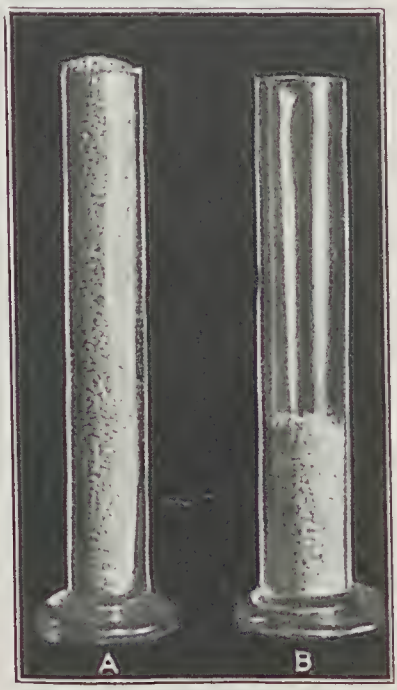


Fig. 3.—Grain from Healthy and Diseased Plants.

A. Yield of twenty-one healthy plants, about 8 ozs.

B. Yield of twenty-one diseased plants, exactly 2½ ozs.

[From *The Smuts of Australia*, by D. McAlpine.]

Infection of the Plant.

Infection of the plant takes place in the very early stages of its growth, viz., seedlings, and in the young shoots which are developed later, and not after the plant is above ground. The fungus remains within the tissues of the plant for varying periods, and only becomes visible to the naked eye after the spores have developed within the leaf.

Loss caused by the Disease.

The actual loss by the disease in Victoria is difficult to estimate, but some idea may be formed when we hear of cases in which 10 per cent. of the crop was destroyed. In one instance which was brought under my notice quite one-third of the crop was killed out in a certain district. Mr. McAlpine, in *The Smuts of Australia*, page 92, mentions a loss of 70 per cent.

Contamination of the Soil.

Contamination of the soil is the most difficult problem in dealing with the control of Flag Smut.

The factors affecting the contamination of the soil are so many and varied, and so intimately connected with the working of the average farm, that it seems almost hopeless to guard completely against the disease. Certain precautions, however, can be taken, more especially when we know the channels by which the disease reaches virgin and other soils. If these be observed, the loss will at least be lessened.

Soil is contaminated through the working horses being fed upon chaff cut from diseased wheaten hay, by animals feeding upon stubble paddocks which have borne a diseased crop, by fragments of diseased flag blown by the wind, or carried by animals or farm implements, and by the spores of the fungus on the seed wheat.

Control.

In all cases where land becomes infected, it is very difficult to eradicate the disease. The cost of fungicides make their application out of the question.

Several sources of contamination are known, and they should be guarded against. Care should be taken to see that chaff is free from disease. Seed should be immersed in a pickle consisting of one and one-half pounds of bluestone to ten gallons of water. If a crop is diseased the stubble should be burnt and not fed off by sheep or cattle. Fallows must be well worked. Sowing should be done, if possible, after rain, and a rotation of crops observed. These are the only known methods of control. Flag Smut affects wheat only, therefore an oat crop will help to clear up a diseased area.

The question often arises: How long will the spores of Flag Smut retain their vitality in the soil? Up to the present, there is no definite evidence on this point, and the data necessary to answer the question will not be available for a number of years.

The breeding of a wheat immune to Flag Smut is of the greatest importance, and, if possible, attempts should be made by plant-breeders in this direction. Success to a greater or less extent has been achieved in the breeding of a rust-proof wheat, but this, perhaps, is of less importance to Victorian growers than the raising of one proof against Flag Smut.

CROP COMPETITIONS IN THE WIMMERA.

RUPANYUP DISTRICT.

Report of the Judge, H. A. Mullett, B.Ag.Sc., Chief Field Officer, Department of Agriculture.

I have much pleasure in forwarding my report as judge of the recent crop competitions held under the auspices of your Society.

Some Impressions of the District.

Rupanyup occupies a position on the south-eastern edge of the extensive belt of black Wimmera soils which are famed for their fertility. Those in the vicinity of Rupanyup comprise some of the most fertile of the whole area, and form what is called the Lallat plain.

In addition, especially towards Marnoo, there are large areas of red soil which have a tendency to set down with wet, and which are consequently much more difficult to manage than the black soil. Both these types of soil are well suited to wheat and sheep raising—though the black is superior—and are being actively farmed. There is, however, a considerable area in the district still being used as a sheep run.

According to the official records, the average rainfall is 16.97 inches annually, and with it fine wheat crops are grown. There are, however, a number of wheat-growing problems peculiar to the district, especially on the red land. The most satisfactory way of solving these is by means of carefully conducted tests in the field, but another way which is of assistance, and by which farmers can help themselves and each other, is an annual district survey of the crops and of the methods by which they have been grown.

The crop competitions, such as have been held during the past two years, offer a splendid opportunity for discovering the best crops each year, and of accounting for their superiority by a consideration of the methods by which they have been raised.

The soil and seasonal influences would, of course, have to be taken into account. Any deductions that may be made by the examination and comparison of a large number of cases have a local value of the highest importance.

There is every reason, therefore, why a crop competition should not be looked upon as a mere struggle for a prize, but rather as a contest of which a wider view must be taken.

A pleasing feature of the Rupanyup district is the superior type of some of the homes with gardens that one sees dotted over the countryside. They reflect the general prosperity that the district enjoys. There is a marked absence of those tumbledown farm buildings which still, unfortunately, mar the landscape in some of our prosperous districts of the wheat belt. That general public attention has in the past been directed to improving the farm homes at Rupanyup is evidenced by the fact that, some years years ago, a farm competition was held annually, though recently it has been allowed to lapse.

No more convincing example of the soundness of the district, and of the fertility of the black Wimmera soils, could be instanced than that supplied by the career of Mr. J. Ramsay.

A few years ago, Mr. Ramsay came to Rupanyup with no capital and no knowledge of farming, and was employed in one of the stores in the town. He eventually decided to go farming, and leased a couple of paddocks, comprising 300 or 400 acres, in the vicinity of the town. No sheep are kept, the area being regarded as too small, yet Mr. Ramsay has been enabled to erect the substantial homestead and improvements shown in the photographs, out of the profits won as a wheat-grower. One of the main secrets of his success is that the small area enables him to work each acre to perfection.

The Season.

The rainfall is the limiting factor in crop production at Rupanyup and, as elsewhere in the wheat belt this year, it was deficient at the critical time of the year, *i.e.*, during the growing period of wheat. In all, 7.0 inches fell during the months of May to October inclusive, or only 1¼ inches more than that registered during the same period in the 1914 drought. In that year, the spring rains almost entirely failed, but this year there were fair falls during September and October. At all events, there was sufficient rain to enable several farmers to raise crops yielding from ten to eleven bags to the acre, but not without their having paid special attention to the placing of as much as possible of the moisture from the year before at the disposal of the crop by carefully worked fallow. Other factors that have helped materially towards the yields are the use of carefully selected varieties of wheat, and liberal dressings of fertilizer. In short, no good crop was raised this year at Rupanyup that had not been well farmed, except in portions of the district where the rainfall was somewhat heavier than the rest.

Results—For Best Crop of Wheat.

Name.	Soil.	Variety.	Yield.	Purity and Trueness to Type	Disease.	Weeds.	Evenness.	Total.
Possible Points ..	.. .. ..	.. .. ..	**35**	**20**	**15**	**15**	**15**	**100**
D. McLennan ..	Black ..	Federation ..	32	19	13	14	14	92
J. C. Hutchings..	Black ..	Federation ..	31	17	14	14	14	90
H. Newell ..	Black ..	Federation ..	27	16	13	14	13	83
Capt. D. B. Payne, M.C.	Mainly red ..	Federation ..	28	15	12	14	13	82
S. Miller ..	Black ..	Federation ..	26	14	11	11	12	74
J. Scott ..	Black ..	Federation ..	23	12	13	11	12	71
J Ramsay ..	Black and red ..	Federation ..	18	17	11	13	12	71

Mr. McLennan's winning crop was one of the most attractive of 70 or 80 inspected in five Wimmera districts this year. It was very even, level, and nicely headed. The seed was true to type, though an odd stranger could be seen. There was a complete absence of weeds or wild oats.

The crop was grown on the "summer" or fifteen months' fallow, which was ploughed after the February rains with a set mouldboard plough to the depth of 4 inches. The fallow was then thoroughly cultivated both before and after harvest, with the object of killing weeds

and conserving the maximum of moisture. The scarifier was the only implement used, and precautions were taken to prevent, as far as possible, the implement stirring the land to the depth of the original ploughing. In all, three workings were given before harvest-time, and three after harvest-time.

The paddock was drilled during the last three weeks in June with Federation wheat, which was purchased direct from the Longerenong College earlier in the year, and was sown at the rate of 60 lbs. per acre with 100 lbs. of superphosphate. It was lightly harrowed behind the drill. This paddock of wheat is especially interesting, in view of the fact that it has been continuously summer-fallowed for the past fourteen years without rest, *i.e.*, seven crops have been taken off it during that period. Mr. McLennan has not noticed any falling off in yield, on the contrary, the yields are stated to be, if anything, better to-day than in the early history of the paddock. Nevertheless, Mr. McLennan admits that the system is not good farming practice, and he proposed to spell the land shortly and introduce oats into the rotation. There is no doubt that continuous summer fallowing in this manner, accompanied,

Mr. Ramsay's Homestead and Buildings.

as is necessary, by the regular burning of the stubbles, must result in depleting the land of its stores of available humus, and eventually reducing fertility, and is not to be recommended as general practice.

But that is not to say that the summer fallow has not a definite place on the average Wimmera farm. Many farmers are finding that it pays best to include both summer and winter fallow in their rotation systems, for the reasons already discussed in this year's report of the Nhill Crop and Fallow Competition.

In the paddock adjoining Mr. McLennan's crop was the exhibit of Mr. H. Newell. This crop had received very similar treatment to its neighbour, the main difference being that it was sown in July. Mr. Newell is inclined to ascribe the lighter yield of his crop to the somewhat later sowing. This crop was drilled with 60 lbs. Federation wheat, and 80 lbs. of manure. The fallow on which it was sown was also summer fallow, being scarified in March, and subsequently re-scarified six or seven times, and then harrowed before and behind the drill. There were some heavy "banks" of wheat in low-lying patches.

The second-prize crop—that of Mr. J. C. Hutchings, "Dalmore," Rupanyup—was a most creditable one, though the yield was not quite

as heavy as that of the winning crop. Points were also deducted because the wheat was not as pure and true to type as it might have been. Under the heading of "absence of disease," and also "weeds," the exhibit scored well. The paddock of wheat presented an even, level, table-top appearance. The method by which the crop was raised is well worth recording, because Mr. Hutchings is a most careful observer, and makes it a practice to test his ideas on a large scale.

The wheat was sown on black land on winter fallow, which was ploughed to 3½ inches in early July. In Mr. Hutchings' opinion, July

Mr. D. McLennan's Winning Crop of Federation.

Mr. Hutchings' Crop.

fallow is superior to summer fallow to an average extent of two bags to the acre; but here it must be stated that he has not the support of the majority of Wimmera farmers. It is quite possible, however, that some types of summer fallow are better than winter fallow, just as the converse may also be true. Both methods have never been systematically tested under controlled conditions. Mr. Hutchings is a strong believer in early fallow, and in harrowing it thoroughly after every rain, and here the general experience of the best farmers backs him up.

On the question of manuring, Mr. Hutchings has an interesting theory, which he arrived at as a result of observations made during the year following the 1914 drought.

It is common knowledge that splendid crops were obtained in 1915, and he ascribed this to the possible encouraging of deep and extensive rooting of the wheat plants by the unused superphosphate which was left in the ground by the drought-stricken crops.

Mr. Hutchings, therefore, determined to sow his manure in two lots, *i.e.*, one 60 lbs. drilled on the fallow after it has been ploughed and well harrowed, and an equal quantity sown with the crop in the ordinary way—*i.e.*, 120 lbs. of superphosphate in all.

The crop inspected had been treated in this way. It is, of course, impossible to gauge the value of this practice without comparative tests, and here we may turn for guidance to the results obtained on the permanent fertilizer trials at Werribee. For a number of years past, it has been the practice to manure one of the fallows with 1 cwt. of superphosphate, in precisely the same way as that under discussion. When the wheat is sown in the following year, a similar dressing is applied. The average results over the past years show that no benefit resulted. Though, until the matter is tested on the black Wimmera soils, it can always be argued that there better results might be obtained.

Mr. Newell's Crop of Federation.

The following are the individual cultural operations that Mr. Hutchings' fallow received.

After the ploughing early in July, it was harrowed twice, drilled with "super.," and then scarified in September, and harrowed. In March it was again harrowed, and finally scarified before the drill. The sowing took place during the first week in June, with 60 lbs. of seed. The crop was not fed off.

Captain Payne's crop was mainly on red land which had received the following treatment.

Ploughed 4 to 5 inches in July, and "logged" with a planker in November to break the clods. The only further treatment given was a scarifying and a partial discing just before sowing, which took place towards the end of May, with 65 lbs. of Federation wheat, and 80 lbs. of superphosphate. The crop was, on the whole, a good one. Points were deducted, however, because the seed was not as true to type as it might have been, and because of a fair amount of takeall. Both this crop

and that of Mr. Hutchings' appeared to have had the benefit of slightly more rain than most of the others. The yield that had been secured in this case with the meagre preparation given, is evidence of the wonderful natural water-retaining qualities that the red Wimmera clays possess.

At present, little is known of the best method of dealing with them, save that they must not be worked down too fine for fear of causing them to set down with the wet. An inquiry into their possibilities might well form the subject of systematic investigation.

Wheat Growing in the Wimmera.

Within the memory of Wimmera farmers, immense strides have been made in wheat-growing methods. Step by step wheat farming has been transformed from a hopeless drudgery to the level of a remunerative pursuit and a science of more or less exact niceties.

The pioneers have witnessed the conquering of what was an untried province, and subsequently its rise to the position of the premier wheat district of the State. They must feel a sense of pride when they contemplate the broad, fertile wheat-fields of to-day, and contrast them with the uninviting bush in the pioneering days.

All this was not achieved except with stout hearts and willing hands, but these alone would not have sufficed. Wheat farming in the Wimmera could not have been placed on its present basis by hard work alone. It was by the discovery and adoption of certain farming practices and machines that the greatest advances have come. No matter how prodigal the expenditure of labour, yields could not have been raised to their present level without the adoption, for instance, of the principle of fallowing and the use of superphosphate, or the discovery of prolific varieties of wheat suited to local conditions, such as Federation, nor could the same profits be made without the invention of such labour-saving implements as the combined harvester and the seed drill.

So far as the actual growing of the wheat crop is concerned, the most important principles that have been recognised during the past twenty years may be quoted under five heads:—

Early fallowing.
Careful cultivation of the fallow.
Liberal manuring with phosphates.
Care and attention to seed.
Systematic crop rotation and the use of sheep.

Farmers are fully agreed on the fundamental truth of these general principles, but no two, however, will agree when it comes to the putting of them into practice. Under a given set of conditions, such things as the exact quantity of manure, the variety of wheat, the quantity of seed, the time of sowing which is best, &c., are always moot points.

It has long been recognised that the best way of determining these questions is by means of carefully conducted experimental plots, though more recently it has been shown that valuable information can also be obtained by a statistical survey of a large number of crops, such as can be made at a farm competition. Thanks to the plots, we are able to supply definite answers to a number of farming problems, though in other cases we have only general experience to guide us.

Fallowing Black Land.

Experiments have proved up to the hilt the profitable nature of careful fallowing, but so far no exact comparison has been made between the average yields of crops grown on summer and winter fallows; nor have the methods of working both types been standardized. If farmers knew which method was the more successful they would undoubtedly adopt it. At present a wide range of implements and methods are utilized.

Two requirements in the managing of Wimmera fallows on the black land stand out. The one is the conservation of the maximum of moisture by early fallowing, and the other is careful working, but not to the detriment of the physical texture of the soil, which must not be made too open and porous.

The task of getting the black soil into a proper condition of tilth is much more difficult than many suppose, and is yet imperfectly understood. But this much is certain, that other things being equal, the

Mr. Hutchings' Substantial Reserves of Hay.

fallow which has been well worked, and yet in which the surface mulch has a certain soft, mellow appearance, is invariably high in moisture below, and will grow the best crops.

To conserve the maximum of moisture in the fallow, it must be cultivated after each rain, so as to break the crust which forms on the surface, as well as, of course, to destroy germinating weeds. When effectively worked in this way, up to 4 inches extra rain can be stored in the fallow in a normal season. But the greatest care must be taken to work the soil with suitable implements when it is in a semi-moist condition, because if this is not done, there is a danger of rendering the fallow too loose and hollow, and it will never take on the mellow texture required.

For instance, late August and September fallow can rarely be made to assume this condition, and continual working with heavy implements, such as the scarifier, seems to aggravate the trouble. The soil becomes harsh and crumbly, and the scarifier wallows to the depth of the original ploughing. On the other hand, where the land is summer fallowed

while moist, or ploughed early in July, the heavy rains which generally follow seem to assist it to knit together satisfactorily.

Again, should the winter rains be scanty, the difficulty in effecting consolidation and tilth is also most marked, as many Wimmera farmers have noticed during the past two seasons. When the soil is in this condition, it may possibly pay to roll it in the spring, and every effort should be made to cultivate it with the spring tooth or harrows as early as possible after any rain. The longer it is left, the more it will dry out, and the greater will be the necessity to use the scarifier because of the stronger growth of the weeds.

That is not to say, however, that the scarifier should not be used where the ground is sufficiently consolidated. For instance, the fallow on which Mr. McLennan's crop was grown received no less than six scarifyings, but this was summer fallow which was worked up while moist after the summer rains, and was given plenty of time to settle down.

The paddock was not re-ploughed, as is sometimes the practice. The condition of this crop contrasted most favorably with those on summer fallow, which had been twice ploughed. The season being abnormally dry, the deeply-worked fallows could not be sufficiently consolidated. On the other hand, in good seasons there is nothing like well-ploughed fallow.

To many farmers, fallowing is simply a method of killing weeds, and of creating a seed bed; but from these considerations it is obvious that the particular method of working, and the class of implement to use, will depend largely on the physical condition of the soil from time to time. The ideal to aim at is 2½ to 3 inches of loose but mellow top soil over a moist, well-consolidated layer underneath. When the soil can be maintained in this condition, every working after the rain is worth a bushel or two extra wheat to the crop.

Manuring.

On the subject of manuring, there is a mass of reliable evidence. The results of the experiments at Longerenong Agricultural College show that the most profitable manure to use on the black Wimmera soils is superphosphate. The average dressing used by Wimmera farmers is about 50 to 60 lbs., but the tests show that it is most profitable to increase the dressing to at least 1 cwt., and on well worked fallow, it has been shown that even 2 cwt. is not the limit. If 1 cwt. of "super." be used instead of 56 lbs., an extra yield averaging about 2 bushels to the acre will result. This will not only pay for the extra manure used, but will return a net profit of from 4s. to 5s. to the acre as well. In addition, it is found that the feed which grows on the stubbles of the crop which has been heavily manured is more than double that which results from the normal dressing.

"Super.," contrary to the usual opinion, helps the crop to tide over dry seasons; the heavily manured crops this year are everywhere the best, and there is no sign of "burning off." Rupanyup farmers are gradually using increased dressings per acre, and right throughout the Wimmera the best crops this year—other things being equal—are those which received dressings of from 100 to 120 lbs. of super.

Care and Attention to Seed.

During the past decade, increasing attention had been paid to the seed in the Wimmera. Prior to that time, interest was mainly centred on tillage and manurial problems. New wheats have been bred, and old varieties have been improved by selection. Investigations have been made into the time of sowing and the best quantity of seed to sow. Federation continues to hold its own where it has not been permitted to run back. Tests at the Longerenong College show that Federation, which has been systematically selected each year, has yielded, on the average, 6 bushels to the acre better than the strain from which it was derived. Penny is a wheat which has demonstrated its ability to hold its own with Federation under Wimmera conditions, and is useful for commencing the sowing season, as also is Yandilla King, though the latter will not do well when sown late in a dry season like the present. The new crossbred, "Gallipoli," continues to give consistently high yields on the experimental plots.

The results of five years' investigations show that July sowing is, on the average, most profitable throughout the Wimmera, though everywhere this year the May and June sowing are bushels to the acre better. The average tests for the period 1915-1919 show that Federation sown in July at the rate of 60 lbs. of seed with 1 cwt. of super., is 2½ bushels to the acre better than when sown in June, although June sowings were nearly three bags to the acre better this year.

Of late years, there is a marked tendency amongst farmers to increase the rate of seeding. That this policy is undoubtedly payable on well-worked black fallow, even in a dry year, is borne out by the results of tests during the past five years, and is the general experience of the best farmers. These tests show that if 75 lbs. of seed (with 1 cwt. "super.") is sown instead of the usual 60 lbs. of seed, the extra 15 lbs. will give an average annual increase of no less than 4 bushels to the acre. There is no justification for the use of extra quantities of seed if the land is not well worked and liberally fertilized.

Though no smut was noticed at Rupanyup, it was very prevalent throughout the Wimmera this year. If the seed be correctly pickled, smut can be entirely eliminated. A full account of a satisfactory method of pickling is given in the report of the farm competition at Dimboola. (See *Journal of Agriculture*, February, 1920.)

Rotation of Crops.

While the general sequence on most Wimmera farms is fallow, wheat, oats, and pasture, a proportion of the wheat is generally sown on fallow which was previously in wheat stubble. Each year sees the increasing prevalence of such diseases as Takeall and Flag Smut in these paddocks. The losses are considerable, and they can only be reduced by clean fallowing and the more general use of the oat crop. No one paddock should be denied an occasional oat crop.

The Wimmera farmers are becoming more and more convinced that it pays to grow oats on well prepared fallow.

Increasing attention has also been paid to the growing of extra feed for sheep. The stubble feed can undoubtedly be doubled by the use of

an extra ½ cwt. of "super." with the previous wheat crop. Many farmers find that it pays to sow in March and April forage crops of oats and barley for the sole use of sheep.

In conclusion, I have to thank the Secretary, Mr. McGowan, and Mr. McCracken for the efficient arrangements which enabled the judging to be carried out expeditiously.

THE FERTILE WIMMERA.

39 Bushels to the Acre with a Rainfall of 5½ inches.

At the annual field day at the Longerenong Agricultural College in 1916, the suggestion was made that a wheat-selection competition should be held under the auspices of the Horsham Agricultural Society. The committee cordially approved of the proposal, and it was decided that the competition should extend over a period of three years, commencing with the 1917-18 season. The object of the competition was to show farmers how they could improve their yields by the selection of good strains of wheat varieties, just as the quality and quantity of wool have been increased, and improved returns from dairy cows obtained. Not only has the competition helped the contestants to increase their yields, but it has also meant that they can obtain good prices for their seed wheat in other parts of the State. Briefly, the participants followed the same system as obtains at the Longerenong Agricultural College, which has received more orders for seed wheat than can be supplied. There is not the slightest reason why the immediate neighbourhood of Horsham should not become famous for its wheat and be looked to by farmers in this and other districts of the State for their supplies of seed.

The result of this season's competition furnishes undoubted evidence of the wonderful fertility of the Wimmera district. Mr. W. Rule, of Pimpinio, was the successful competitor. His one-fifth of an acre plot returned at the rate of 39 bushels to the acre on a rainfall of only 5½ inches from the time the seed was sown until the grain was harvested. Mr. J. Lehmann, of Greenland Dam, obtained a yield of 33.1 bushels; and Mr. E. Baker, of Jung, 32.3 bushels. The crops of Messrs. Rule and Lehmann were grown on black, heavy, typical district land, rich in lime, and commonly described by farmers as lignum flats. In the two preceding seasons, Mr. Lehmann was first, Mr. Rule second, and Mr. L. Hutcheson third.

The Judge's Report.

At the monthly meeting of the committee of the Horsham Agricultural Society in the Town Hall, Mr. A. C. Drevermann, the principal of the Longerenong Agricultural College, who acted as judge, submitted

the following report on the seed wheat selection competitions for the third or final year, season 1919-20:—

Stud Plots, each One-fifth of an Acre.

Name.	Type.		Uniformity.		Yield.			Max.	Total.
	Max.	Award.	Max.	Award.	Max.	Bus.	Award.	Points.	Award.
E. Baker ..	10	9	10	8½	30	32·3	24·8	50	42·0
J. Lehmann ..	10	10	10	10	30	33.1	25·4	50	43·4
W. Rule ..	10	9	10	9	30	39.0	30·0	50	48·0
Seed Plots, each 3 Acres.									
E. Baker ..	10	8½	10	7½	30	29·5	27·5	50	48·5
J. Lehmann ..	10	10	10	9	30	20·0	28·0	50	47·5
W. Rule ..	10	8½	10	8	30	32·1	30·0	50	40·3
Bulk Plots, 30 Acres.									
E. Baker ..	20	18	20	16	60	29·5	55·1	100	89·1
J. Lehmann ..	20	20	20	16	60	30·0	56·0	100	92·0
W. Rule ..	20	16	20	15	60	32·1	60·0	100	91·0

Summary.

Name.	Address.	Stud.	Seed.	Bulk.	Total Points.
W. Rule	Pimpinio ...	48·0	46·5	91·0	185·5
J. Lehmann	Greenland Dam ...	43·4	47·0	92·0	184·4
E. Baker	Jung	42·3	48·5	89·1	174·9

Messrs. L. Hutcheson and F. Wollermann competed in the first two years of the competition, but withdrew from the third. The former had disposed of his property, and the plots on the latter's farm were damaged by sheep. All the competitors are so well satisfied with the result of the little extra work necessary to keep up the standard of the wheat by selecting the best plants to supply seed for the small stud plots, that they intend to continue the work for their own benefit, irrespective of further competitions. The variety grown in each case was Federation.

Mr. Rule said that the one-fifth of an acre plot was fallowed in July, 1918, and left for about three weeks, when it was harrowed and scarified about three weeks later. It was harrowed and scarified again in March, 1919, and was subsequently harrowed and lightly scarified before the drill, and then harrowed about a week after the seed was sown. About 18 lbs. of seed was used to sow the plot, and 1 cwt. of superphosphate was used. The other ground was similarly worked, but owing to his

inability to obtain adequate supplies, 100 lbs. of superphosphate to the acre was used on the seed plot, and only 90 lbs. to the acre on the bulk plot. The yield from both of these plots was the high one of 32.1 bushels per acre. Mr. Rule stated that in the first year of the competition he selected sufficient seed out of the ordinary wheat field to sow one-fifth of an acre. In the second year, enough heads were selected from the stud plot to sow one-fifth of an acre and also to sow the seed plot of 3 acres. The same method was adopted in the third year. Mr. Rule has selected sufficient seed from the last season's stud plot to sow one-fifth of an acre, and he obtained 33 bags off the seed plot of 3 acres to sow the bulk plot of 30 acres. In 1917-18, the first year of the competition, when there was a good rainfall, Mr. Rule harvested at the rate of 49 bushels off the one-fifth of an acre plot. The result of the competition, Mr. Rule said, showed that the generous use of artificial manure in a dry season does not adversely affect the yield, rather is the contrary the case. His experience showed that fully a sheep to the acre more can

Preparing for the 1920 Peace Crop.

be carried on manured land in the succeeding season than on land not so treated.

How Crops were Grown.

Mr. Lehmann states:—The land for the competition plots was ploughed in March, 1918, and left until July, when it was re-ploughed, and shortly afterwards harrowed. It was subsequently scarified twice during the spring. In April, 1919, it was again harrowed and scarified, and left until June, when it was scarified again, and sown. A few days after it was sown it was harrowed. The quantity of manure used was at the rate of 90 lbs. per acre on the one-fifth acre plot, and 70 lbs. per acre on other plots. About 15 lbs. of seed was used on the one-fifth acre plot, and at the rate of 70 lbs. to the acre on the others. The manure used was superphosphate, and the variety of wheat sown was Federation. The selection of wheat was carried out according to the rules of the competition. Sufficient heads were picked from this year's stud plot to carry on for the next year. Apart from the extra yield per acre,

the cleanness of seed, trueness to type, and the uniformity of crop well repaid for the time required in selecting the heads.

Mr. Baker states:—The land on which the three plots was sown was fallowed in August, 1918, and about two weeks later was harrowed with heavy harrows, and about the end of October was scarified. Again, in February, 1919, I ran the scarifier, with a light "Poppy" harrow attached to it, only skimming the surface about 1 inch, so as to kill the wild melon and stop the ground frm cracking. Then I scarified it just ahead of the drill. After drilling, I harrowed it again (about eight or nine days later). The previous year I had a record yield from the 3-acre plot, taking 47½ bags, which would average 196 lbs. per bag. The quantity of manure on this plot was 95 lbs. From the one-fifth acre plot I got 2⅓ bags, the quantity of manure being 98 lbs.

ENCOURAGING PROSPECTS FOR THE FLAX INDUSTRY.

In 1918 the Imperial Government undertook to purchase all the fibre from the 1918 and 1919 Australian flax crops at £170 c.i.f. United Kingdom port. Recently this contract was cancelled, and arrangements were made to sell the fibre on the open market.

The advantages resulting from this change of policy have exceeded the most sanguine expectations, for the Commonwealth Flax Committee has just received advice that the first consignment of 14 tons to be disposed of in the open market have realized the highly satisfactory price of £325 per ton.

Recent reports received show the shortage of flax fibre is still very acute, and it is expected that equally satisfactory prices will be received for fibre yet to be sold.

As recently announced the Commonwealth Government has guaranteed £6 per ton for standard flax for this year, and a price which has still to be definitely fixed, but which will not be less than £5 for flax grown during the two succeeding years.

With a guarantee of remunerative prices for three years there is every incentive for farmers in suitable districts to not only grow flax, but to co-operate in the erection of flax mills for the treatment of their straw. Moreover, the Committee points out that £6 per ton is merely a guarantee, and that any profits on the scheme over and above milling expenses will be returned to the growers. Thus on the 1918 crop an interim bonus of £2 per ton over the guaranteed price has been paid to growers, and when the whole of the products of this crop have been disposed of there will be a further substantial amount available for distribution.

In view of the high prices now ruling for fibre and other flax products, especially linseed, and the probable continuance of such high prices the Committee is confident that it will be able to pay growers of each crop substantial dividends in addition to the guaranteed prices.

It is considered that the prospects of the flax industry were never so bright, and farmers are urged to take full advantage of this unique opportunity by sowing a record acreage of flax this year.

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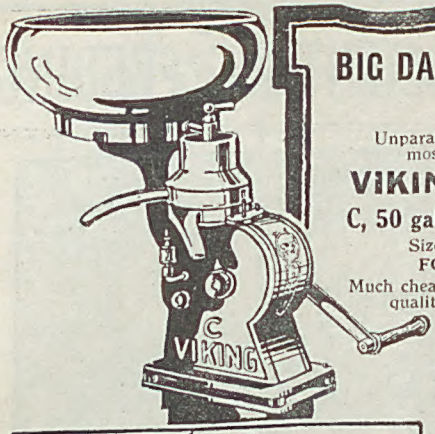

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